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How We Built Standard Costs Into Control and Planning

by GEORGE K. BRYANT

Controller, RCA Home Instrument Division, Radio Corporation of America, Camden, N. J.

Solution of policy, procedure, and internal relations problems which accompanied replacement of job order by standard costs, is described in this article which also underscores the full and accepted use of engineered standards in the fields of purchase and plant cost control and acceptance also of sales programming for future periods. A six-plant operation is involved.

A STANDARD COST SYSTEM, like any other type of cost system, is the service part of the financial function. Controllers and accounting executives have commented that they use their cost systems to control direct labor costs, overhead costs, material costs, or efficiencies, etc. These are all worthwhile objectives—short term objectives, to be sure, but nevertheless commendable goals. They contribute to the long-term objective. The true purpose of the standard cost system is to make available an effective tool for management to help insure a satisfactory figure in the lower right-hand corner of the profit and loss statement. Any other objective of the standard cost system is merely a means to this end.

The present discussion covers first-hand experiences as encountered specifically in the television operations of the RCA Victor Home Instrument Division. The division is responsible for the manufacture and sale of television receivers, radio receivers, and "Victrola" phonographs and, incidentally, for making a profit on the operations. We have, therefore, a very comprehensive objective in the administration of our standard cost system. Ours is a three-fold system, each part is important in itself, and each is inter-related with the others. The combined effect of the three functions, which is many times greater than the sum of

the three, has served to lift our accounting controls from the level of bookkeeping techniques, to the place where they become dynamic forces playing an important part in our overall effort to offer the best in quality and value at the lowest possible price and with a fair profit in return.

The three major elements of our standard cost system, which will be dealt with separately, are:

1. The function which deals with the control of purchased material cost.
2. The function which deals with the control of plant or manufacturing cost.
3. The function which guides future commercial planning.

Perhaps a thumbnail sketch of our type of operation will help the reader to understand the requirements of and reasons for this type of control system. The Home Instrument Division operation is made up of six separate manufacturing plants in widely separated geographical locations, plus a home office. We have two separate plants which manufacture RCA Victor television receivers that are about equal in production capacity and are very large plants. We have a plant which produces all of our RCA Victor radio receivers. The fourth plant produces all of our "Victrola" phonograph and record playing equipment. It also operates a large parts fabrication facility used not only for "Victrola" phonographs but also for supplying parts to our television and radio receiver plants. The fifth plant manufactures wood cabinets for the television receivers. The sixth plant manufactures products for government contracts.

CONTROL OF PURCHASED MATERIAL COSTS

With that brief background we can move on to the first element of our standard cost system, the control of purchased material cost. Since we are primarily the assemblers of instruments and purchase the larger portion of our parts and components, our material cost represents well over half of our total plant cost. For this reason, we have more than a casual interest in what our material costs amount to, why they cost what they do, and whether or not we believe these costs could be lowered.

Development of Material Standards: Before Centralization

The history of our progress in developing standard cost of materials is a revealing narrative. When we first installed our standard cost system about ten years ago, it was set up to conform to the usual principles of such a system. At that time, all the manufacturing plants were semi-independent of one another and each plant controlled its own engineering design, purchasing, manufacturing methods and financial operations. When we began operations under

a standard cost system, all incoming material was received at standard and charged into an inventory account at standard, the difference in cost between actual and standard being written off to the purchased material variance account. The material remained at this standard cost throughout the manufacturing process, which included various inventory accounts en route. When the completed instrument reached finished goods inventory, the material content equaled the sum total of the standard cost of the entire bill of material. This was a neat trick, considering that we had just converted from a shop order system of cost accounting, where all material was valued at actual on a "first in, first out" system.

At that time, there seemed to be one weak spot in the system as related to materials costs. How do you establish a standard cost on a purchased component? It was suggested that the solution was simple enough. Just get the buyers in the purchasing department to obtain three quotations on each item. The lowest quotation would be the standard. That decision almost cost us the ball game! In the first place, the lowest quoting vendor often did not get the business because of a variety of reasons: poor quality history, poor performance, inability to deliver on time, lack of capacity, history of repeated price increases and many other reasons. Also, because our standard cost system was part and parcel of the cost estimating system, we were requesting these quotations on all parts considered for future business. After several months, our purchasing department had such a backlog of requests for quotations they could not get their current buying job done. We were so far behind on standard costs and estimates, because of lack of quotations, that the commercial plans of the sales department were delayed and already people were being criticized for not meeting standard cost.

Then came a second decision equally "brilliant." It was decided that purchased material standard cost be determined at the average of three quotations on each part. This change in policy accomplished two things. Obviously, the dollar level of the standards increased, since we were using average cost rather than the lowest cost. Furthermore, our work load increased considerably, since we had to average three quotations instead of discarding two of them. Other than that, we had all the same troubles and inefficiencies we suffered before.

Development of Material Standards: Under Centralization

The way out appeared when the company centralized operations. As part of the centralization plans, it had been decided to establish a centralized cost estimating function in the home office, with the manager reporting to the controller instead of the manufacturing manager. This change, which was considered to

be a radical step at the time, has since proven to be a very sound decision. The cost estimating functions in the plants were to be dissolved and the new home office function would be responsible for establishing standard costs for all plants. This was to be a strong function with the complete backing of top management.

At first, it was difficult to get beyond mere notions. Our company was going through an expansion program. There were no people hired for the job and no office space available either. Desks, chairs, typewriters and calculators were all on back orders on existing functions. Worst of all, there was no precedent for the job or function. Requests began coming in from the sales department for cost estimates on future business and, at the same time, plants were receiving raw materials but had no standard cost. We had to move fast. We hired the people, the supervisors and the group managers. We acquired temporary space and we begged or borrowed office facilities and equipment. We were in business but we faced a multitude of problems. One of the most serious problems was the fact that, when we accumulated all the standard cost data from all the plants, we realized that the part used in as many as four different plants had as many as four different standard cost dollars values. Each of the plants was very willing to go to a centralized system as long as we used its system as standard.

In spite of our problems, two steps were taken immediately. The first was a short-range plan. This amounted to the establishing of "temporary standards" as a stop-gap until we could establish engineered standards. The second step was a critical one and one which has made our present success possible. We presented a long-range plan to management, which established the aims and goals of our standard cost system and the broad application throughout our operations. The acceptance and continued support of these principles by top management has made our system eminently successful.

As we look back, these principles, as they apply to purchased material standards, are basically simple. We purchased tens of thousands of different items. Each item usually was "sourced" with two or more vendors. It would be impossible to tabulate the wage rates, the overhead rates and the facilities of each of our vendors. Even if it could be done, it would surely be impossible to utilize this information in a standard cost system. Therefore, we engineer our own standards. First of all, we break down purchased material standards into two categories: standards for items we either process or buy and standards for those we only buy. The parts we do not process are made up of shelf items, such as lock washers, screws, nuts, etc. These, for the most part, are stock items sold on a very competitive market and usually can be purchased at the same price from a number of sources and suppliers. The standard cost on these items is established at the current market price.

Standard Cost for Parts Both Purchased and Made

The items we do process, with the alternative of buying them, consist of such items as wood cabinets, plastic cabinets, plastic parts, stampings, screw machine parts, coils, transformers, speakers, controls and all such other special items. Since our standard costs remain in effect for one year, once each year we analyze the current market value of all basic materials. We determine the mill price on steel in all of its forms, and on copper, aluminium, bronze, zinc, etc. We determine the market price on wire, paper, plastic powder, plating materials, paint materials, wood, glue, foil, and all other basic raw materials. We had our personnel department through its wage and salary division, find out the average wage rates in certain geographical locations, the rates for occupations such as punch press operators, screw machine operators, assemblers, winders and hundreds of other occupational rates. We acquired through two sources, our purchasing and personnel departments, the average prevailing overhead liquidating rates in geographical areas by machine centers. From this basic data, we established standard labor and overhead rates to be used as the standard rate for the coming year.

With this preliminary work accomplished, we were ready to go to work in establishing our standard costs for items in the make or buy category. Every individual component or part is designed by engineers, drafted and blueprints made. A copy of the blueprint is received by our cost estimating department and the same day a standard cost is issued. Specialists in manufacturing methods, timestudy and processing are employed in this section. From the blueprint and their knowledge of manufacturing methods, they determine the weight or volume of materials needed per 1000 pieces. This is priced out at the standard value of raw material and allowances are made for normal cut-off and scrap, based on efficient utilization of the material.

Next, we turn to the processing operations for the parts, in sequence, and synthetic time values are applied. These time values are extended by the standard wage rate data and a standard overhead allowance is applied. Allowances are made to convert select time to standard time. The synthetic time values used, or pre-rates as they are sometimes called, are identical to those used in our own manufacturing plants prior to the actual time study. Assembly operation allowances vary with restrictions of difficulty, just as allowances for tight tolerances vary on machining operations. Experience with many tens of thousands of estimates, later time studied, has proven the accuracy of these pre-rates.

The cost of material, labor and overhead at this point is totaled. It is

known to us as the "efficiency standard." This is the cost we would expect our own plant to incur in the production of this item if they manufactured it. However, to this cost we must add an allowance for administrative costs and profit. This total cost becomes the purchased material standard. The engineering of these standards assumes modern methods and tools, the economical purchasing of material on the part of the vendor, and reasonable allowances for administrative cost and profit.

A copy of the standard cost is forwarded to the purchasing department which routes it to the chief buyer, according to the type of product. Here it is filed by drawing number, and, when the buyer later receives a requisition to procure "X" thousands of the part, he has in his possession not only the standard cost but the detail of material, labor and overhead content and the sequence of operations that should be followed in producing the part. On the standard cost card also is an estimate of tool cost. The cost accounting section of the plants also receive the standard cost in the form of a punched card, so that, when the material is received, they can properly charge the inventory account and write off any variance to the purchased material variance account.

How the Standard Costs Are Used in Purchasing

As can be seen, we have come a long way from the time when we asked the purchasing department to get quotations on which to base standards. We now advise the purchasing department how much the particular item should cost. We do not always buy at standard. For one thing, during the period of a year, material and labor costs are apt to change. A few years back, we experienced a three-year period where variances started out high at the beginning of the year and steadily decreased to the point later in the year where we reflected black variances, indicating, of course, that we were purchasing below the standard cost. Recently, of course, all changes have been upward. Furthermore, we assume modern, up-to-date, efficient machines, methods and tools and we do not always find this combination among our vendors. As a result, we experience an unfavorable purchased material variance. This we take into consideration in our forecasts of profit and loss figures for the year and also in long-range forecasts. You might ask, "Why establish standards if they are not factual?" The answer is: they are all attainable under favorable conditions, they are our goal, and we are constantly striving to achieve this goal.

It was mentioned earlier that our standard cost system is a comprehensive plan and has a broad application throughout our operations. This is nowhere more true than with our material standards. In addition to being used for

establishing inventory values and recording variances, this system provides a great number of other services. We have been able to negotiate price reductions of literally millions of dollars by sitting down with individual vendors and comparing their cost breakdown with our standard cost breakdown. We have been asked to pay for costly automatic tools and progressive dies in conjunction with piece prices based on nonautomatic methods of production. Our buyers have discovered some vendors figuring on additional unnecessary manufacturing operations because they misinterpreted the blueprint. Wide variances in material have been eliminated. Some vendors, after a cost comparison, have been quick to admit that, perhaps, the loadings and profit figure were a bit out of line. Adjustments in purchase order prices were negotiated downward. This system can be used as an extremely effective tool in controlling purchased material cost.

A further use of this system of material standards for cost control comes as a by-product. Certain summary information on a standard cost card is key punched into a tabulating card. Included in this information is a commodity code number identifying the part as to a particular group of materials, such as coils, resistors, metal stampings, etc. At the end of each month, we run off total dollars and percentage of variances by commodity groups. This enables us, not only to follow the trend of price changes by commodity but also, since our purchasing department is so organized that chief buyers and buyers are responsible for all purchases within specific commodity groups, tells us how each buyer is performing against standard in total for his activity.

Help in Product Design, Analysis of Competitors' Costs

Still another use of the standard cost system is its application to cost reduction through product design. Here, of course, material standards are directly relevant. The individual standards are readily available to the design engineers. Since we set out a unit cost for every operation in sequence, the design engineer can ordinarily tell at a glance what savings are possible through elimination of unnecessary specifications. This detail is also valuable in comparing costs. For instance, the engineer can evaluate the difference in cost which should result if he specified metal stampings as against a die casting design.

A still further refinement relates to forecasting material variances. We key punch tabulating cards for all purchase orders. Included in the information on these cards are the price, quantity and the monthly schedule of delivery for the life of the purchase order. By collating these cards with our standard cost cards, we can project a purchased material variance by commodity and total in

dollars and percentage for the next three months. Assuming all purchased material is received as scheduled, we know exactly our variance for the coming three months. This, of course, is an invaluable aid in forecasting profits for the months to come.

To mention just one more advantage of our system of standard cost for materials, it serves as a valuable aid to the sales department and to top management in costing our competitors' models. In our business, occasionally, we find a competitor who offers an instrument for sale at a lower price than our model. This has a very depressing effect on our sales department and they become unhappy and go around with long faces for days. So, we purchase this bargain competitive set and send it to the engineering laboratory for test measurements and then to the cost section. The cost boys literally tear the set to pieces. They establish an estimated cost, based on our system of standard cost, so that the cost is on a comparable basis. We then report to the sales department that it is true that this set is cheaper to manufacture than ours by, say, $15 and we explain that we, too, can have a lower manufacturing cost and a resulting lower list price if we are willing to accept certain changes in performance.

We then demonstrate a comparison of features and performance and advise the sales management personnel department that, if they choose, they can give up their mahogany cabinet and have a plain pine cabinet covered with oil cloth, a cardboard printed bezel, three less receiving tubes, sixty less resistors, forty less capacitors and a decrease in all wiring components. We hasten to demonstrate, however, that this will result in smeary pictures and static and interference problems caused by man-made conditions. Furthermore, the customer will not be able to tune the best picture and the best sound at the same place on the dial. We enumerate the other loss of performance features as a result of this cheaper design. We know before we hold our meeting with the sales department what the answer will be, but we go through this routine at periodic intervals just the same.

CONTROL OF PLANT COSTS

So much for purchased material standards. We come now to the second use of our standard costs, as discerned at the start, i.e., the control of plant cost. This function of our standard cost system involves establishing standard costs on manufacturing or assembly of a complete instrument. Our present system has been highly successful for the past several years. It was a great relief to us. As mentioned earlier, in discussing purchased material standards, we converted from a shop order system of costing. We have had occasions in which two similar instruments ran through manufacturing assembly in adjacent physical

areas, with amazing results. An older, more experienced foreman would, shall we say, borrow material from the adjacent manufacturing area, or he would withdraw an accumulation of material from the stockroom without clear record of the charges involved. When we closed out the shop orders, one job ran a material variance of more than 100% and the other shop order would reflect a total material usage as a net credit! It would almost seem that the veteran foreman built all his production without any material and returned some to the stockroom. It was no wonder that we, in accounting, welcomed the opportunity to try out the standard cost system.

The Problem of Setting Process Standards on a Centralized Basis

Nevertheless, we made the comparable mistake in establishing manufacturing and assembly standards that we did in setting purchased material standards. As already narrated, in the beginning we asked the purchasing department to set our purchased material standards by asking for quotations. We also asked the manufacturing division to establish standards by agreeing to accept the time studied process card which they prepared as the standard. However, we at once encountered an epidemic of process cards without any times rates on them. In their place were the initials T.B.S. (to be studied). It was inevitable that the work of setting standards was, at first, less important to production people than it seemed to us.

Then followed the same general sequence of events discussed in connection with purchased material standards. When centralization finally came to pass, we in the home office were without people, without space, without facilities, and without precedent. We were charged with the responsibility of establishing manufacturing standards as well as purchasing standards. Our first step in relationship to manufacturing standards was to acquire all plant processes and time studies and the technical data on pre-rates or synthetic standard rates. Just as we found with purchased material standards, all plants had different time values of assembly operations. The time allowed to drive a self-tapping screw or spin a nut or solder a joint, varied in all plants. One plant had an incentive union contract, the others were on daywork. Operations considered direct labor in one plant were considered overhead in another, and, even as material handling in the third. To complicate matters, one plant was independently located. Another was a tenant plant leasing its facilities and services from another RCA Victor department. This played havoc with uniformity of liquidation rates among the plants. Then, too, we had separate labor contracts in each plant

and negotiated with different unions. From the standpoint of establishing standard costs, we definitely were faced with an Herculean task.

Formulating Policy; Its Acceptance by Management

In order to solve the multiple problems we faced, we again took two basic steps. They were the same as in establishing purchased material standards, i.e., a short-term and a long-range policy. The short-term policy served merely as a stop-gap. We established plant manufacturing standards—good, bad or indifferent—for a short period of time, so that plants could have some measurement of their operations. The long-term policy consisted of two parts. The first was a recommendation to our top management which they subscribed to and have backed with complete enthusiasm ever since.

To state our departmental policy simply, we believe in the philosophy that one of the basic requirements of a standard cost system is to record variances currently and that these measure operating efficiencies. In this manner, cost reduction efforts can be applied to specific areas at the earliest possible moment. We were willing to accept the fact that a standard cost system is not necessarily designed to provide a historical record of actual cost by model, as under a shop order system. Although variances by model can be obtained by analysis under a standard cost system, we believe that the additional accounting costs would be out of proportion to the value derived. We are much more interested in knowing where the variance was incurred and which function was responsible than in finding out which model should be charged with the variance.

As part of our philosophy, our standards are established as theoretical standards and not expected actual costs. These standards are purposely set up as ideals to be striven for, and it is necessary to maintain good average performance under favorable conditions to achieve this standard. The goal is attainable only by 100 per cent labor efficiency, after allowances, and a highly efficient performance against a tight budget for overhead and material handling expense. As a result of this philosophy, our manufacturing management recognized that favorable variances are attainable only by the application of highly efficient administration at all levels. They recognized, too, that unfavorable variances indicate costs which could be reduced or eliminated by aggressive action on their part.

Gaining the Confidence of The Plants

The second part of our long-range program consisted of a campaign to gain

the confidence and trust of the plants. The manufacturing plants, for the first time in our history, were being measured for efficiency and overall operating costs by a remote group of people located in the home office. It will readily be recognized that it is vitally necessary for the manufacturing plants to have full confidence that the standards are equitable and fair. The administration of the standard cost system becomes deeper than a company operation. It becomes a personal problem with a lot of people, since salary increases, bonuses, and promotions of individuals might be affected by performance against these standards. For the benefit of those accountants who believe that accounting requires no salesmanship, it should be said that it took a lot of selling to get our program accepted. Because our proposed standards were established as ideals or goals, the manufacturing division, at the start, gave this whole program a less than warm reception. Assurances from the home office that we did not expect 100 per cent performance against these tight standards were not enough. Past experience had convinced that any unfavorable variances caused trouble.

It became apparent that, in order for our program to succeed, we had to establish a *degree* of variance against standard. We solved this by bringing our budgeting operations into the scene. Since the plants were required to submit monthly and quarterly budgets, we arranged to have the budgets modified to forecast the variances in detail for the period involved. Then, if these plant budgets were acceptable to the controller's office, the plants would be held accountable, not for the total variance but only the amount of variance which exceeded the budgeted amount. That decision proved to be a very wise one but, again, it took a lot of selling.

Obviously, our long-range program was not an easy one to carry out. First, we hired or transferred into the department qualified men with previous experience as manufacturing methods engineers. We acquired process engineers, time study engineers, and some foremen from the machine shop with the right qualifications, plus the clerical help needed. We devoted a lot of time creating morale and team spirit within this new department. Some personnel proved much better adapted to the work than others and the first two years necessitated many replacements. Meantime, we held meetings with the manufacturing methods managers in the plants and correlated the basic time study standards, or pre-rates, into one common manual which incorporated all synthetic time values. This program alone took nearly a year to accomplish. We arranged for experienced supervisors from the plants to lecture for two and three day periods on fundamentals. At the end of the first year, we had arrived at a basis which all plants subscribed to. The key to success was that the home office did not dic-

tate to the plants and demand acceptance of the home office standards. Instead, we worked out by mutual agreement a department-wide manual which all had a part in. The home office did not conduct lectures in the plants. Instead, the plant representatives conducted the lectures in the home office.

While all his was going on, we worked with the plant managers and plant accountants on the problem of standardizing operations, so that the same operations were considered direct labor in all plants. We defined by agreement the operations which constituted material handling. Meanwhile, we succeeded in establishing overhead liquidation rates, material handling liquidation rates, variance allowances, material allowances, build-up allowances, and all the others. With these basic elements standardized, we proceeded to compile standard costs for complete instruments for all plants.

Considering Each Plant's Situation

Thus, the second phase of our long-range objective, to gain the confidence of the plants, was already well under way. Since our basic standards were arrived at by participation by all plants and our definitions of direct labor, overhead and material handling were arrived at in the same manner, we had already begun to build confidence. Furthermore, since we purposely refrained from issuing any directives to the plants, we further enlisted their confidence. Next, we defined certain variances which were not the responsibility of the plant manager. Purchased material variance, for instance, was eliminated from the plant manager's responsibility, since, following our centralization of organization, all purchasing was performed in the home office. Other variances caused by centralized home office functions were also eliminated from the plant manager's variance responsibility but reassigned as the responsibility of other operating people.

Because of the very large volume in our plants, a few pennies variance against a standard resulted in a large total variance. The importance of a sound standard applicable to each individual plant was, therefore, obvious. Since our plants varied in physical facilities, a theoretical standard cost could account for variances within individual plants. One of the important factors influencing this variance was a factor of line balance caused by actual physical conditions. This problem was solved by agreeing that the first theoretical estimate issued by the home office would be a temporary standard only. After the instrument was actually processed and time studied on the line and the line balanced, the plant time study and process would be used as a standard if (and this is a big if) it were agreed to by the home office cost group.

In order for the home office cost group to agree with the process and time

study, the plants are required to submit a detailed process, including time values, for approval. The question came up, "Suppose there is lack of agreement in the processed time, then what?" In that event, it was established that any such problem would be mutually settled between the general plant manager, to whom all the plant managers report, and the controller, to whom the cost sections report. It is now eight years later and no disagreements have ever had to be settled at this level. Many disagreements have occurred but they have always been worked out between the proper people at the right level.

GUIDING COMMERCIAL PLANNING

The third major function of the standard cost system deals with the function of future commercial planning. All of our commercial planning is guided by our standard cost system. During the period of our current programs, we issue standard gross margin reports. These reports list all models by product lines, showing the recommended discount patterns, selling price to distributor, standard costs, and standard gross margin in dollars and percentage. The standard gross margin is the difference between sales revenue and standard cost before variances and expenses. The phrase "standard gross margin" is a byword among our entire management group. The individuals making it up may not be able to tell within $50 to $100 the cost or selling price of the set but they know that the standard gross margin is 17.1 per cent or 22.3 per cent or whatever it happens to be. They are currently advised as to the break-even point in standard gross margin percentage. If, for instance, the break-even point happened to be 10 per cent, then a model earning 15 per cent standard gross margin means 5 per cent net profit.

Variance, by category, on the profit and loss statement seem to fall into patterns according to operating conditions. These variances are watched and analyzed very carefully, not only from the dollar standpoint but by percentage. Current variances, expressed in percentages, are constantly compared to past performance and conclusions drawn which lead to management decisions. When we study a proposed new line of merchandise, all models are costed on the standard cost basis. The costs are not final standards to be used in measuring operations but they are on the same relative basis, and accurate enough to be used for pricing purposes.

The problem of engineering standards on proposed new merchandise is, of course, considerably more difficult than establishing standard costs on current models. New lines of merchandise planned for the future often incorporate new materials, new molding powder for plastics, even metals which are new to our manufacturing operations. We encounter new and radically differently

designed components as a result of the fast engineering pace in the electronic industry. New materials bring about new processes and, often, new machines and new tools. In the preliminary planning stage, we must work primarily with oral information and free-hand sketches provided by the engineers. Obviously, there are no signed-off blueprints, which make the establishing of standard costs much simpler. (A concrete example of establishing preliminary standard costs on new materials and new methods is the future program of color television).

Sales Plans Nos. 1 to 100 (More or Less)

We begin our commercial planning a year in advance. The sales and merchandise divisions compile a proposed commercial plan for the coming year, which lists models and quantities, with proposed list prices and proposed discount patterns. For each of these models, we must have an estimated standard cost. From this information, we prepare a tabulation of the standard gross margin by model and the total standard gross margin expressed in dollars and percentage. To be sure of our prospects, we carry this out to a forecast profit and loss statement on which we forecast the variances and expenses and the net profit for the year, but, in many management meetings, the subject never gets beyond the indicated standard gross margin percentage.

If this figure is unsatisfactory, which it usually is for Plan 1, we put together Plan 2. This may consist of changes in proposed prices, quantities and discounts, or it might consist of a change in specifications for certain proposed models, or a different line-up of models. If the revised plan involves no physical change in the merchandise, it is simply a computation job. If, on the other hand, management recommendations indicate physical changes or additions or deletions from the merchandise line, additional work by the cost group with the engineering department is involved. Usually, the plan finally accepted by management as our program for the coming year is some such number as 67G or 92K, indicating that not only approximately 100 basic plans have preceded it, but that there have been many variations of some of the basic plans!

Do not be misled into believing that list prices are determined solely on the basis of cost and standard gross margin. In our highly competitive business, suggested list prices are primarily established by competition. Obviously, if the basic price level in the industry for a television table model is $199, we could not arbitrarily elect to create a sales program around an RCA Victor table model television line beginning at $259. Although competition is the major factor in establishing price ranges, our standard cost system does provide the necessary tool in further developing and refining our sales program to fit into the price requirements as established by competitive pricing.

Furthermore, it should be pointed out that, in planning a complete sales program, including all models from the lowest price to the more expensive, it is not possible to price every individual model in its logical price sequence based solely on the expected standard gross margin of the individual model. It becomes necessary, sometimes, to knowingly price a model with specific features which will yield somewhat less gross margin than should be forthcoming. In many instances, this is very good business. The total profit for the department may, in such circumstances, even be increased. If, for instance, in the opinion of our commercial people, the total quantity of sales for the year can be substantially increased, thus giving us additional manufacturing volume and (more importantly) additional sales revenue, this type of program pricing can result in substantially increased profit per dollars. It is also possible, under certain circumstances, by including in the line some models which are planned to earn less than the normal standard gross margin, to make sure of the sale of a greater quantity of higher priced models which earn a somewhat better standard gross margin than normal.

This method of forecasting has proven so accurate over a period of years that our management has complete confidence in the standard cost system. As a matter of fact, the accuracy is taken for granted. Experience has shown that, when a forecast sales program carries to the end of the year without major quantity or price changes, the profits earned and the original forecast profit are so close that it is hard to believe.

THE SECRET OF LIVE STANDARDS IS TIMING

In conclusion, it should be emphasized that one of the most important factors contributing to the success of our standard cost system is the factor of timing. The importance of timing is realized when we consider that standard costs on purchased or manufactured parts are established the same day the blueprints are released by the engineering division. The buyer in the purchasing department has a detailed standard cost before he is required to "source" the part or request quotation. The plants receive standard costs before they go into production. Tentative standards are used for pricing and forecasting before the sales program is approved.

It is this factor of timing that makes our standards live standards. These live standards which are used to control purchased material costs, to control manufacturing costs and to aid in future commercial planning, enable us to price competitively, currently and for the future. And, because they satisfactorily fulfill this need they serve our management as a major tool to help insure satisfactory profits.

Developmental Costs Incurred in the Plant

by MAURICE J. MOSS

Head, Accounting Department, Kodak Park Works, Eastman Kodak Company, Rochester, New York

Not all developmental costs are laboratory-identified. Those which appear among production department costs may be lost to control if there is no procedure in force to segregate, budget and review them. Such a procedure, used in a large plant, is described and illustrated in this article.

THE DEVELOPMENT OF THE INDUSTRIAL RESEARCH LABORATORY is a familiar story. There are few large industrial companies today which do not have well-equipped and adequately-staffed research departments, with the principal function of carrying on fundamental research in fields basic to the operation of the company. The modern industrial concern cannot maintain its competitive position unless it has an active research program. Much research is not carried on in the laboratory, however, but in the production departments of the plant. Furthermore, the developmental work of ideas, conceived in the laboratory, must be performed by the production personnel. Consequently production departments become staffed with technical personnel and significant portions of the machine capacities are devoted to experimental and developmental work.

Here, the industrial accountant is faced with a difficult problem, since the expenditures for such work are apt to become buried deep down in manufacturing costs. Increasingly large sums are being spent on experimental and developmental work in the factory and, although we should recognize that the growth of the company is closely allied with the judicious use of such funds, it becomes necessary for the accountant to ferret out these hidden expenditures and establish adequate controls over them, so as to insure that his management gets its money's worth. It is the purpose of this article to describe how our plant, Kodak Park Works, is coping with this problem.

Kodak Park Works is the largest plant of Eastman Kodak Company. By the very nature of our type of production, we are required to spend large sums in improving our products and processes. We manufacture sensitized photographic goods, including all types of films and papers, as well as the chemicals to process them. We employ over 20,000 people. The basic tool employed in our program is the experimental works order, which follows job order costing principles. An experimental works order (referred to as an E.W.O. and given a number

identity) is issued for each major project and becomes the unit for work planning and expenditure control.

It is necessary to realize that this element of cost is controlled by company policy and is not inherently related to current sales or volume of production. Moreover, it is also intrinsically difficult to measure experimental and developmental effort of any type and, because of this, unless special steps are taken, management has more problems in determining the proper appropriation for such work than for the routine and more easily measurable costs. As an example of special situations which exist in factory research, it is our practice to include staff personnel, i.e., technical men, supervision, etc., in our regular production department step-level budgets, even though we know in advance their efforts may be expended on experimental work. Thus, we have a dual control since we also include these items in the E.W.O. appropriations, treating such expenditures as a transfer of cost from the regular classification.

Separating Experimental Costs and Organizing to Control Them

In any effort to achieve adequate analysis and control over both normal and experimental costs in the factory, it is important to have a clear understanding as to exactly what is to be, and, correspondingly, what is not to be, included in experimental works orders. The following two lists contain our definitions on this point:

What Should Be Included—

1. Pure research, i.e., direct research or experimentation on general problems having no particular connection with the various products currently being manufactured by the plant.
2. Projects directing experimental or developmental effort toward the creation of new processes or new product or group of products to be manufactured by the plant. It is not intended that this should cover minor changes in which an existing product is replaced by, or improved by, another. Major developments resulting in an entirely new product or processes should be included, although they replace current products.
3. Projects directing experimental or development effort toward any improvement to a specific product already being manufactured by the plant or an improvement in an existing process. This category would include any work necessary to correct production difficulties which have existed in products or processes since the product was considered acceptable for the trade.
4. All further work beyond the developmental stage necessary to get a new product, model, or item of equipment ready for normal production and sale.
5. Projects for the purpose of designing and constructing new types of equipment or improvements to existing equipment which shall be used in our manufacturing processes and which will effect a change in any existing process in the plant.

What Should Not Be Included—

1. Technical advice or service rendered to production departments in order to help them out of difficulty or to carry on their normal operations.
2. Trouble shooting which is necessary to correct production difficulties which occur from time to time and which have reduced normal standards of products or processes.

SIMPLIFIED ORGANIZATION CHART SHOWING RESPONSIBILITY FOR EXPERIMENTAL WORKS ORDERS

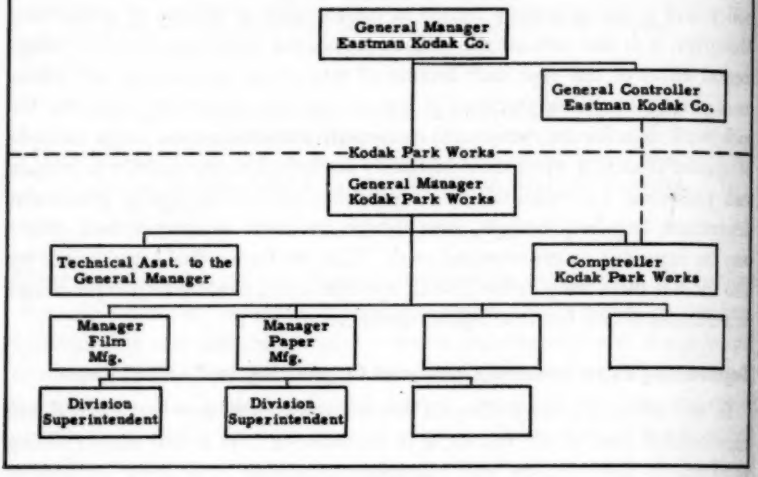


EXHIBIT 1

3. Any other work done which is essential to normal operations (in contrast to new work which can be done, or not done, depending on the wishes of management).
4. The cost of producing, experimentally or otherwise, any material or article on the specific order of a customer when the material or article can not reasonably be expected to lead to a product which will be added to our regular line.
5. Routine tests necessary for normal production procedure on a regular product.

In order to understand the experimental works order procedure to be covered in subsequent paragraphs, some understanding of the basic organization chart of Kodak Park Works, as presented in Exhibit 1, is necessary. The principle of bottom-up management is of primary importance and fundamental to Eastman Kodak Company's policy. The division superintendent, indicated in the simplified organization chart, whose division may be in the magnitude of 200 to 2,000 or more employees, is a very important person in the Kodak organization. He has complete responsibility for a division and has been given the authority to carry out that responsibility. His is a line function.

The accounting department acts in a staff capacity to provide him with information necessary to secure adequate cost control over all expenditures, including experimental works orders expenditures. Also, since experimental and developmental work is vital to the progress of our industry, top management has

EXPERIMENTAL WORK ORDER REQUEST

(--- --- Department)

To: Plant Manager

E. W. O. 1253 - Design and Construct a New Type Spooling Machine

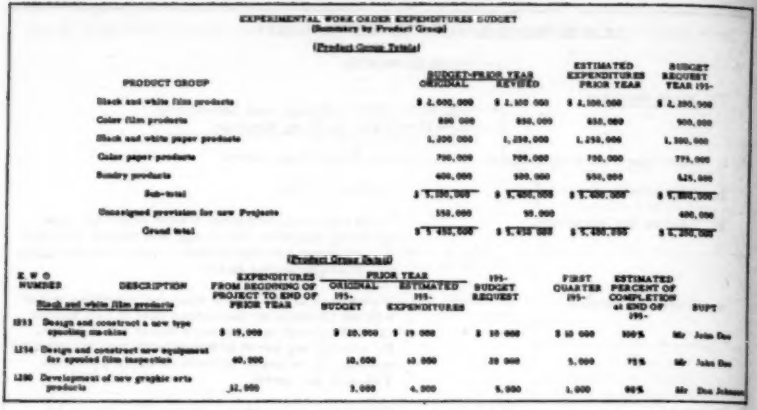
1.	Department making request	Roll Film Department
2.	Date of request -	October 1, 195-
3.	Reason for project -	To design and construct a new type roll film spooling machine which will overcome current maintenance problems and reduce substantially our manufacturing cost.
4.	Expected results -	We expect to develop a spooling machine which will be flexible to the extent that it can handle all widths and operate on a three trick basis. By combining several operations and increasing speeds, it is hoped to reduce costs by about $50,000 per year.
5.	Estimated time to complete -	Originally requested January 195- and to be completed by the end of 195-
6.	Estimated cost of entire project -	$ 50,000
7.	Estimated cost for year -	
	(a) Cost of engineering and construction work.	$ 25,000
	(b) All other costs.	$ 5,000
	Total	$ 30,000
8.	Estimated cost in first quarter -	$ 10,000
9.	Any other information which might be of interest to management -	Maintenance costs and downtime have been an increasing problem during the last two years. With increased production requirements forecast for the future years it is imperative that this machine be developed to meet the forecast work load with the present space and work force.
10.	Recommended cost distribution -	All roll films
11.	Percentage of completion to which this appropriation will carry the project -	100%

EXHIBIT 2

deemed it necessary to establish one man, the technical assistant to the Kodak Park general manager (indicated in Exhibit 1) as the individual whose chief duty it is to act for top management in the follow-up of experimental and developmental work. All E.W.O. budgets and reports are channelled through the technical assistant for his review and recommendation to the general manager.

Establishing the Budget for Experimental Work

In the fall of each year, the technical assistant to the general manager sends a letter to all superintendents requesting them to furnish an estimate of their



EXPERIMENTAL WORK ORDER EXPENDITURES BUDGET
(Summary by Product Group)

(Product Group Totals)

PRODUCT GROUP	BUDGET—PRIOR YEAR ORIGINAL	BUDGET—PRIOR YEAR REVISED	ESTIMATED EXPENDITURES PRIOR YEAR	BUDGET REQUEST YEAR 19—
Black and white film products	$ 2,000,000	$ 2,100,000	$ 2,100,000	$ 2,250,000
Color film products	800,000	850,000	850,000	900,000
Black and white paper products	1,200,000	1,250,000	1,250,000	1,300,000
Color paper products	700,000	700,000	700,000	775,000
Sundry products	600,000	550,000	550,000	625,000
Sub-total	$ 5,300,000	$ 5,450,000	$ 5,450,000	$ 5,850,000
Unassigned provision for new Projects	150,000	50,000		400,000
Grand total	$ 5,450,000	$ 5,450,000	$ 5,450,000	$ 6,250,000

(Product Group Detail)

E. W. O. NUMBER	DESCRIPTION	EXPENDITURES FROM BEGINNING OF PROJECT TO END OF PRIOR YEAR	PRIOR YEAR ORIGINAL 19— BUDGET	PRIOR YEAR ESTIMATED 19— EXPENDITURES	19— BUDGET REQUEST	FIRST QUARTER 19—	ESTIMATED PERCENT OF COMPLETION at END OF 19—	SUPT
Black and white film products								
1213	Design and construct a new type spooling machine	$ 15,000	$ 20,000	$ 19,000	$ 10,000	$ 10,000	100%	Mr. John Doe
1214	Design and construct new equipment for spooled film inspection	60,000	10,000	10,000	20,000	5,000	75%	Mr. John Doe
1220	Development of new graphic arts products	11,000	5,000	4,000	5,000	1,000	90%	Mr. Don Johnson

EXHIBIT 3

E.W.O. expenditures for the forthcoming year. The superintendents are requested to divide their request in two parts, i.e., for specific projects in process which will be continued during the ensuing year, and for new specific projects. The following information is requested for each project:

1. Department making request.
2. Date of request.
3. Reason for project.
4. Expected results.
5. Estimated time necessary to complete.
6. Estimated cost of entire project.
7. Estimated cost for the ensuing year divided as follows:
   (a) Cost of engineering, construction, and maintenance. (Engineering, Construction and Maintenance Department is a large centralized service department performing this type of work.)
   (b) All other costs.
8. Estimated cost for first quarter of the ensuing year.
9. Any other information which might be of interest to management in connection with the project.
10. Recommendation as to where cost should be charged.
11. Per cent of completion to which this appropriation will carry the project.

Upon receipt of letters from the division superintendents (Exhibit 2), the data is supplied to the accounting department, which uses the information to prepare the Kodak Park experimental work budget for the ensuing year. This is summarized by product group (Exhibit 3) and responsibility (Exhibit 4). The aggregate experimental annual budget and all subsequent appropriations over $5,000 for the unassigned provision require the approval of the Kodak Park comptroller and Kodak Park general manager, the general manager, general comptroller, assistant general manager of the company, and the president and chairman of the board.

EXPERIMENTAL WORK ORDER EXPENDITURES BUDGET

1. Summary by Responsibility - Detail by Individuals

Manager	Division Superintendent	Prior year budget request	Estimated prior year Expenditures	195- Budget Request	Budget First Quarter 195-
Mr. O. Zoe	Mr. J. Doe	$150,000	$ 145,000	$ 200,000	$ 60,000
	Mr. D. Johnson	400,000	450,000	600,000	150,000
	Mr. T. Black	550,000	500,000	550,000	140,000
	Total	$1,100,000	$1,095,000	$1,350,000	$350,000
Mr. D. White	Mr. B. Brown	$ 500,000	$ 550,000	$ 600,000	$125,000
Mr D. White	Mr. T. Green	1,200,000	1,300,000	1,400,000	300,000
	Total	1,700,000	$1,850,000	$2,000,000	$425,000

2. Summary by Responsibility - Detail by Projects

Div. Supt. Mr. John Doe Dept. Roll Film

E.W.O. Number	Description	Original prior year budget	Estimated prior year budget	195- Budget Request	Budget first quarter 195-	Acct. Number	Cost Distribut.
1253	Design and construct a new type spooling machine	$20,000	$ 19,000	$ 30,000	$ 10,000	220-01	All roll films
1254	Design and construct a new equipment for inspection of spooled films.	10,000	10,000	20,000	5,000	220-02	All roll films

EXHIBIT 4

Cost Chargeable to Projects

The cost of experimental projects should reflect, as far as practical, the true and complete cost of the work done. This means, not only the "out of pocket" expenditures but also a reasonable share of the overhead based upon the extent to which experimental work adds to the overhead in the long run. Materials cost includes all raw materials purchased specifically for the project, all regular production materials or parts which are used for the experiment, and the cost of equipment and tools made or purchased specifically for the project. Experimental direct labor is labor expended directly on the project. This may include direct labor employees or indirect labor such as staff men, technicians, etc. All labor is included in departmental labor and burden budgets and handled as a distribution of departmental cost, rather than as a labor transfer. Burden is distributed to E.W.O.'s each period, using either the labor distribution report or other normally accepted bases. The amount of burden to be distributed is computed, applying appropriate rates to the unit of measure used in each department.

In production departments, where labor has been expended on an E.W.O. and the regular production facilities and the equipment of the department have

PERIODIC CONTROL STATEMENTS OF EXPERIMENTAL WORK ORDER EXPENDITURES

1. Detail by Project

E.W.O. NUMBER	DESCRIPTION	ANNUAL BUDGET**	CURRENT PERIOD EXPENDITURES	CURRENT PERIOD OVER OR UNDER BUDGET	YEAR-TO-DATE EXPENDITURES	YEAR-TO-DATE OVER OR UNDER BUDGET
1253	Design and construct a new type spooling machine	$ 30,000	$ 3,000	$ 333	$ 9,000	$ 1,000
1254	Design and construct new equipment for inspection of spooled film	20,000	2,566	900*	4,500	500

2. Detail by Division Superintendent

Manager Mr. O. Zoe

	Period____	Year____
Mr. J. Doe	$ 200,000	$ 19,206	$ 794	$ 57,000	$ 3,000
Mr. D. Johnson	600,000	47,000	3,000	140,000	10,000
Mr. T Black	560,000	44,000	1,000	135,000	5,000

3. Detail by Manager and Division Superintendent

Manager	Division Superintendent		Period___	Year_____
Mr. O. Zoe	Mr. J. Doe	$200,000	$19,206	$794	$57,000	$3,000
	Mr. D. Johnson	600,000	47,000	3,000	140,000	10,000
	Mr. T. Black	560,000	44,000	1,000	135,000	5,000
Total Mr. Zoe		$1,360,000	$110,000	$4,794	$332,000	$18,000
Mr D. White	Mr. D. Brown	600,000	42,000	3,000	120,000	5,000
	Mr. T. Green	1,450,000	92,000	8,000	290,000	10,000
Total Mr. White		$2,050,000	$134,000	$11,000	$410,000	$15,000

**Revised to include additional authorizations and refunds.

EXHIBIT 5

been used, the full burden rate normally applied for that type of equipment is used. Such rates, however, should not be affected by unusual decreases in forecast production. Where labor has been expended on an E.W.O. but the regular production facilities and equipment of the department have *not* been used, burden is applied at a reduced rate but commensurate with the extent to which the experimental work adds to the overhead of the department in the long run. In establishing these rates, elements of indirect labor, expense supplies, and employee benefits are included. In contrast, general plant expense costs, power department costs, depreciation, maintenance costs, and service department costs, are excluded. The full burden of service departments or departments specifically set up to carry on experimental work, are charged to E.W.O.'s, including fixed charges of these departments.

Reporting by Responsibility and (to Management) Product Class

Having established the annual budget and determined the method by which costs are to be allocated to the experimental job orders, it becomes necessary to develop a series of reports to follow adequately the progress of various projects

REPORT TO MANAGEMENT OF EXPERIMENTAL WORK ORDER EXPENDITURES
BY PRODUCT CLASS
(3 Periods Ended March 19--)
(Summary)

PRODUCT GROUP	ANNUAL BUDGET ORIGINAL	ANNUAL BUDGET REVISED	EXPENDITURES YEAR-TO-DATE	OVERPOR UNDER EXPENDED BALANCE	ADDITIONS OR REVISIONS REQUIRED
Black and white film products	$2,200,000	$2,250,000	$525,000	$1,705,000	$25,000
Color film products	900,000	925,000	200,000	725,000	50,000
Black and white paper products	1,500,000	1,520,000	530,000	990,000	40,000
Color paper products	775,000	775,000	190,000	585,000	50,000
Sundry products	625,000	640,000	160,000	480,000	--
Sub-total	$6,000,000	$6,110,000	$1,605,000	$4,475,000	$120,000
Unassigned provision for new projects	400,000	325,000		330,000	125,000
Grand total	$6,400,000	$6,200,000	$1,605,000	$4,795,000	

(Project Detail)

DESCRIPTION	E.W.O. NUMBER	ANNUAL BUDGET ORIGINAL	ANNUAL BUDGET REVISED	EXPENDITURES YEAR-TO-DATE	OVERPOR UNDER EXPENDED BALANCE	ANNUAL BUDGET CHANGES REQUIRED ADDITIONAL	ANNUAL BUDGET CHANGES REQUIRED REVISED	SUPT
Black and white film products								
Design and construct a new type spooling machine	1255	$ 30,000		$ 9,000	$ 21,000	$ 5,000	$	Mr. John Doe
Development of new graphic arts products	1254	20,000		4,500	15,500	-		Mr. John Doe
Design and construct new equipment for inspection of spooled films	1250	5,500		1,500	3,500	-		Mr. Don Johnson
Develop new film to replace product X	1500		10,000	2,000	8,000	-		Mr. T. Black

EXHIBIT 6

against the budget as established. In doing this, we are currently using several principal reports. The first is a period statement to division superintendents and is illustrated by Section 1, Exhibit 5. Eastman Kodak Company operates under the thirteen-period calendar system in which each period contains four full weeks. At the close of each period, a report is produced for each divisional superintendent through a tabulating system. This report gives the superintendents, by projects, the amounts for annual budget, current period expenditures, current period over or under budget, year-to-date expenditures, and year-to-date over or under budget. In addition to this report, there is made available to the superintendents of the larger departments detailed listings of costs for each E.W.O., by source, which enables him adequately to analyze all charges to each project.

In addition to the detailed listing given to the division superintendent, a report is made for each manager (Section 2 of Exhibit 5), giving him the same information by division superintendent. Also a summary report (Section 3 of Exhibit 5) is prepared for the technical assistant to the general manager and the general manager.

Although it is necessary to follow experimental costs at the plant level by responsibility and all reports at this level are divided by responsibility, the primary interest of top management of the company is to see that experimental effort is channeled into lines which they are most interested in developing. Therefore, all reporting to top company management is divided by product class. Four times a year, i.e., at the end of each quarter, a statement is made showing

EXPERIMENTAL WORK ORDER QUARTERLY BUDGET REVIEW
AT END OF FIRST QUARTER 19--

Dept. Mr. John Doe Dept. Roll Films

E.W.O. NUMBER	DESCRIPTION	COST TO BEGINNING OF CURRENT YEAR	ANNUAL BUDGET	BUDGET APPLIED YEAR-TO-DATE	ACTUAL COST YEAR-TO-DATE	ESTIMATED EXPENDITURES NEXT QUARTER	REVISION OF ANNUAL BUDGET** ADDITIONAL REQUIRED	REFUNDS
1253	Design and construct a new type spooling machine	$ 19,000	$ 30,000	$ 10,000	$ 9,000	$ 6,000	$ 5,000	
1254	Design and construct new equipment for inspection of spooled films	40,000	20,000	5,000	4,500	6,000		
	Total	$ 490,000	$ 600,000	$ 45,000	$ 37,000	$ 35,000	$ 10,000	-

*Data furnished by respective supt. **Significant changes to be explained by letter

EXHIBIT 7

expenditures by product class in summary and in detail (Exhibit 6). This supplies the amount of the annual budget, both original and as it may be revised, expenditures for the year-to-date, over or under expended balance, and additions or refunds required.

Budget Review and Revision Procedure

It is felt that formalized complete reviews of the experimental program are necessary during the year, in order to make sure of the accomplishment of the objectives originally planned, as well as to secure an increased measure of control over the expenditures for the varoius projects. Accordingly, at the end of the third, sixth, and ninth periods, each divisional superintendent responsible is requested by Kodak Park management to review each of his E.W.O.'s by comparing year-to-date expenditures to the annual budget for the project. In doing this, it is determined whether additional funds may be required during the remainder of the year or whether refunds of original amounts, due to cancellations or postponement of work originally planned, should be made.

To assist in this review, the accounting department sends a tabulated form containing the necessary information, to each superintendent on each project for which he is responsible. Included are E.W.O. number and description of the project, expenditures prior to the beginning of the current year, annual budget (including prior revisions during the current year), budget applied for the current year to date, and actual expenditures for the current year to date. The superintendent then adds information for each E.W.O. as to estimated expenditures during the next quarter, and request for revision to annual budget, either for additional funds which will be required or refunds of previously approved authorizations. He returns the form to the accounting department which prepares a listing of all E.W.O.'s (Exhibit 7) and the summaries which were referred to previously as Exhibit 6, for review and approval by management.

Six Fundamentals for Factory Experimental Costs Control

The foregoing pages have outlined and illustrated the procedure which we have developed to control experimental expenditures being made by our production departments. Equally important is the fact that a follow-up has been established, so that all echelons of management know of the progress being accomplished on the various projects. It is our feeling that, for this type of budget, an under-run due to a failure to do the work as planned, may be more deleterious to the objectives of our management than an over-run due to excess expenditures.

It is desirable, nevertheless, to see that, for each dollar expended, we receive a dollar's worth of true experimental effort. By the very nature of this type of work, we are many times dealing with intangibles. Effectiveness is difficult to measure. It is only by a close coordination and follow-up from bottom to top and top to bottom so that everyone is aware of the status of the work involved that we can feel reasonably assured that our objectives are being achieved. Any system which permits expenditures for experimental work by production departments to remain buried in the various normal cost categories is apt to be unduly expensive, without letting those in responsible postions become aware of the true situation.

Although our plan may not be satisfactory in all respects and we are continuing to improve upon it, it is our feeling that recognizing the problem and taking the steps we have described have been of immeasurable value. On the basis of these considerations it is possible to say that any plan for the evaluation and control of factory experimental and developmental costs should include the the following underlying steps:

1. Establishment of lines of responsibility and authority.
2. Definition of area to be covered, i.e., what is experimental and developmental work?
3. Establishment of costs to be included.
4. Creation of a budget and reports against that budget.
5. Establishment of a means of revision of the budget.
6. Education of all levels of supervision and management so as to insure adequate interest and follow-up.

Developmental Costs Incurred in a Company Laboratory

by WALTER E. ARTHUR

Manager, General Accounting Services, General Engineering Laboratory, General Electric Company, Schenectady, New York

Not pure research, but extensive activity in the development of products and processes is carried on by the company unit, the cost control experience of which is reflected in this article. Major attention is given to costs following customer request or orders which involve development services.

THE WORD, CONTROL, when associated with development work, may imply that the work is planned and scheduled in an orderly fashion and the costs follow a pattern, as do manufacturing operations. However, someone has stated that you cannot schedule inventions. This also implies that its costs cannot be controlled. Still, they can be measured, and, if the measuring is done with a reasonable degree of accuracy, the amount of money spent during a stated time can be kept within the limitations of authorized funds.

Let us examine certain operations and practices of a large laboratory of the General Electric Company. The work performed falls in several broad categories:

1. Contract development for the Government or industry, to produce a specific device to perform a function which either has not been done before or is a radical improvement on present practices.
2. Development of new products which may become going lines for the parent company.
3. Highly technical tests on existing products to obtain data for improved quality or performance.
4. Consulting services to other departments of the company on advanced technical or measurement problems.
5. Manufacture of pilot lots of new products to test both the market and the products acceptance.
6. Special development projects for operating departments to improve their product lines.
7. Investigation of techniques, materials, and procedures, with the objective of broadening their application within the company.

Work performed is not of a research nature but, rather, an intermediate step between the research and manufacturing functions. However, the work is essentially new. It has not been done before or is a different application of known principles. Standards for such work do not exist, as the job performed today is seldom repeated tomorrow. Hence cost control requires measuring the costs of diverse process and product changes and, while the patterns of cost incurred

in these endeavors, are often similar, they are seldom duplicated. The work is performed by a group of engineers with specialized education and training. They are supported by a larger group of assistants, technicians, and draftsmen, together with adequate shop and procurement facilities to convert the visions and ideas into samples of the ultimate product.

The laboratory is operated on a cost basis and no commercial or sales organization as such is maintained. All work is performed for other company units, which maintain the required commercial contacts with outside customers. However, because no organization is complete unto itself, some work must be subcontracted. It is also necessary to procure materials, parts, and components from vendors.

The Over-All Budget by Development Expenditures

Over-all control is through the budget with annual expenditures indicated under rather broad categories, as shown in Exhibit 1. Generally, experience indicates that costs other than salaries and wages bear, in the aggregate, a direct relationship to salaries and wages. Therefore, top management can regulate total annual expenditures for development work by controlling the number of employees engaged in that work. That is why the first section of Exhibit 1 budgets the personnel of the division.

Approval of the development budget is the responsibility of the vice-president in charge of engineering services and the president's budget review committee. Further details of proposed expenditures are submitted, showing specific projects for the department for which the work is to be performed and the type of financing for each phase of work. Approval of the budget constitutes approval to maintain a maximum employment level consistent with the orders which may be secured for services and products. It also represents approval, up to a maximum, for cost of an expense nature and for capital equipment.

Development Cost Procedure Related to Customer Orders

When a request for services or products is received, management first determines if it can be honored under the policy requirements of the laboratory. If so, it is then turned over to the cost estimators who classify it as to the type or degree of risk involved. A review requires answers to the following:

1. Is the work desired something radically new?
2. Can specifications and performance be definitely stated?
3. Are facilities and personnel available to meet the customer's delivery date?

DEVELOPMENT BUDGET 1954

NUMBER OF EMPLOYEES

DETAIL	ESTIMATED 1953	BUDGET 1954
Engineers		
Engineering Assistants		
Technicians		
Draftsmen		
Shop		
Clerical		
Stenographers		
Total		

EXPENDITURES

Direct costs	$	$
Salaries and wages paid to employees		
Materials purchased		
Subcontracting and other costs		
Services obtained from other company components		
Total direct costs		
Indirect costs		
Salaries and wages paid to employees		
Supplies purchased		
Traveling and entertaining		
Depreciation and other fixed costs		
Assessments		
Total indirect costs		
Total expenditures		
Capital expenditures		

APPLICATION OF EXPENDITURES

	Customer department A	B	C	D		
Contract development						
Consulting services						
Services performed for other company components						
Pilot lot manufacture						
Under-over absorption of costs						
Total						

EXHIBIT 1

The type of risk is graded down to the point of duplication of something performed before. The cost estimator, engineer and shop planner then work out, in as much detail as possible, a plan for the performance of the job. In specific cases, there are no drawings, no detailed specifications and little more than an engineer's verbal picture of what he proposes to build. Very seldom are there complete drawings and specifications. Between the extremes are many variations.

COST ESTIMATE

Subject .....
Quantity ..... Number .....
Customer .....
Type of Quotation ..... Prepared by .....
Classification of Risk .....

ITEM	QUANTITY	DESCRIPTION	MATERIAL COST	DIRECT LABOR HOURS	DIRECT LABOR COST
		TOTALS	.....	.....	.....
		Indirect costs	.....	.....	
		Shipping, transportation & other costs	.....	.....	
		Contingency	.....	.....	
		Total			
		Total estimated cost			

EXHIBIT 2

The final estimate will show engineering and drafting man-hours and costs, major items of material, shop labor for various components, estimates of subcontracting and other costs. A liquidation factor for indirect cost is added and an over-all contingency based on experience and the type of risk. Before issuing the quotation to the customer, various levels of management approval are obtained, depending on the size of the order. In general, these quotations are on a fixed cost basis and, if the order for the work is obtained, it will be billed at the quotation. The difference between actual cost and billing is charged to a variance account for which the department manager is accountable. Exhibit 2 shows the type of information which the estimate will include.

As orders for development work are received, they are logged by a requisition service group and engineering instructions are issued to the project engineer, shop procurement, cost, shipping and other interested units. A job order system is used for cost accumulation and the details of the cost estimate are given to supervision responsible for various phases of the job, including the number of hours allowed and the dollar value of each class of labor. For this purpose, labor costs within the laboratory are accumulated weekly through the use of tabulating equipment. A breakdown is made available by class of labor.

On orders placed with outside vendors, the purchasing section obtains fixed prices, wherever possible. When this is not practical, the buyer provides estimated costs. On orders placed within the company, it is not always feasible, because of the lack of specifications, to obtain cost estimates from the department to which the work is assigned. In such cases, the procurement personnel gives its estimate of the number of hours required to perform the specific job.

ANALYSIS OF COST—PROGRESS REPORT

Job Order..... Promise Date ..... Quantity .....
Description .....
Customer Order Number .....

	ESTIMATED COST	EXPENDITURES TO
Direct costs		
Engineering		
Drafting		
Shop		
Test		
Total		
Indirect cost—Overhead		
Material		
Subcontracting		
Other costs		
Contingency		
Total cost		
Comments		

EXHIBIT 3

Copies of all estimates are forwarded to the general accounting group. Each order in excess of $50 is recorded as a commitment and, as bills are received, an adjustment is made from the specific order. On completion, the commitment and all billings received are removed from the record. Once a month, a tabulation of all outstanding commitments is prepared and forwarded to the cost units. Because of the uncertainty of the scope of some orders placed, the commitment report is not entirely accurate. However, it provides information which formerly was on a pure guess basis, and experience indicates that, in the majority of cases, it is sufficiently accurate to enable "up-to-the-minute" reporting of costs. Copies of all vendors' bills are sent to the cost units as they are received.

A detailed monthly report of job costs is prepared for each operating department and unit having job responsibility. The report summarizes labor costs by class of labor and also shows material, subcontracting and other costs. Although actual labor costs are tabulated one week after they are incurred, the cost units, from their close contact with the jobs, have a fairly accurate knowledge of what employees are assigned to the work and, in preparing the monthly report on each (Exhibit 3), labor is estimated up to the date of issuing the report.

It is, therefore, possible, through the use of commitment data and estimates of labor, to present to operating supervision an up-to-the-minute status report

EXAMPLES OF REPORTS ON NONCUSTOMER DEVELOPMENT

Product Development Report

APPROPRIATION NUMBER	DESCRIPTION	EXPENDITURES CURRENT PERIOD	EXPENDITURES TO DATE	APPROPRIATION
82-650	Development of a spectrophotometer	100	10 000	12 000

Project Progress Report

	OBJECTIVES AND PROGRESS TO DATE	COMPLETION DATE ORIGINAL ESTIMATE	COMPLETION DATE PRESENT ESTIMATE	EXPENDITURES ORIGINAL ESTIMATE	EXPENDITURES PRESENT ESTIMATE
82-650	To develop a low-cost instrument for the measurement of color. Engineering 75% completed. Drafting instructions issued.	12-1-53	12-1-53	12 000	13 000

EXHIBIT 4

of all jobs for which they are responsible. Such reports give the following information: authorization reference, laboratory shop order reference, date job was started, title, estimated completion date, current month's expenditures, year-to-date expenditures, aggregate-to-date expenditures, estimated costs accrued to report date, total expenditures and estimated costs, amount authorized, estimated backlog, and comments. This information is then used as a basis for a review by the operating departments, comparing physical completion on each job with percentage of estimated cost expended.

Also, the cost units, themselves, keep alert. Specific jobs may show indications of overexpenditures and, therefore, require immediate attention. When this becomes apparent, the cost units prepare a specific job report for supervision, showing similar data to the regular monthly report. Top management does not receive copies of detailed job reports. It does receive, however, monthly summary reports of over-all operations showing data as outlined in the budget, comparing expenditures with budget.

Development Costs Not Related to Customer Orders

Certain development activities are initiated by the laboratory and financed by allocation of company funds. These activities are liquidated, upon successful completion, against the benefiting activity. There are also expenditures of an overhead nature, as well as plant improvements. The over-all control of these is

obtained from the annual budget. Detailed control is through an appropriation routine which requires various levels of management approval in accordance with the amount of the appropriation request. Monthly reports of expenditures are prepared by the general accounting department, showing both budget and appropriation comparisons. These reports are for top management, both on the operating and staff levels. Exhibit 4 shows headings for such reports.

Cost Organization of a Development Division

Estimating, recording, and reporting of accurate up-to-the-minute expenditures are essential to adequate control of costs. After these functions have been performed, however, it is equally necessary that appropriate action be taken. The organization of a development division must be such as to assign complete responsibility and to both measure and reward the successful carrying out of that responsibility. The financial responsibility for the financial operation of the laboratory is assigned to a financial manager, and all accounting, cost and payroll personnel report to him. Cost units are physically located in the operating departments. Although they report operating costs to the department manager, they are responsible to the financial manager and report to him conditions which need special attention.

Through this organization structure, all levels of management are informed of the variances from approved expenditure allowances, either through specific reports or by the financial manager. This does not prevent over-expenditure on specific jobs, but it does help management to make intelligent decisions in controlling, curtailing, altering the pattern, or obtaining more adequate financing of the many tasks assigned to a development division.

Lowering Retail Inventory Shortages Through Training

by HERBERT A. TANZER

Assistant Controller, Macy's Kansas City, Kansas City, Missouri

A program conducted by a department store controller's office and affecting the activities of buyers and sales staff, is here outlined. It has as its objective advance management of those circumstances which commonly result in differences between book and physical inventories under the retail method and is not primarily concerned with shortages arising through dishonesty.

NEAR THE END OF EVERY FISCAL YEAR (and sometimes in the middle, too) practically every department store takes inventory of its stock on hand and compares the results to the totals appearing in the perpetual inventory records, in terms of the total retail value of stock on hand. As a result of this comparison, it is almost invariably found that the physical stocks have shrunk below the perpetual stock figure by an amount ranging from one to one and one half per cent of the total sales for the year. In fact, shrinkage of this sort is so universally expected that it is the normal practice in retail accounting to allow for estimated shrinkage in all interim operating statements. These allowances are computed on both a departmental and total store basis.

Where does this shortage come from? It must be recognized that a significant part occurs as a result of dealings with dishonest customers and employees. The variety of merchandise available, its desirability and comparative ease of accessibility and, most important, the need to permit customer refunds on a decentralized basis, are all factors which accentuate this portion of the problem. Inescapably, these factors are present to a degree seldom experienced in the manufacturing or wholesale industries. However, this is only a part of the problem and it may not be the greater part. Many people who have had experience with retail shortage problems for a number of years are convinced that dishonesty, with all its ramifications, will not usually explain more than one half of a store's total shortage. This is reflected in the reprobation skeptically expressed in regard to any department with a particularly bad shortage record, "They would have needed trucks to carry out this much merchandise."

Thus, there is plainly something else that is also creating shortage. To oversimplify, this something else may be described as carelessness and ignorance.

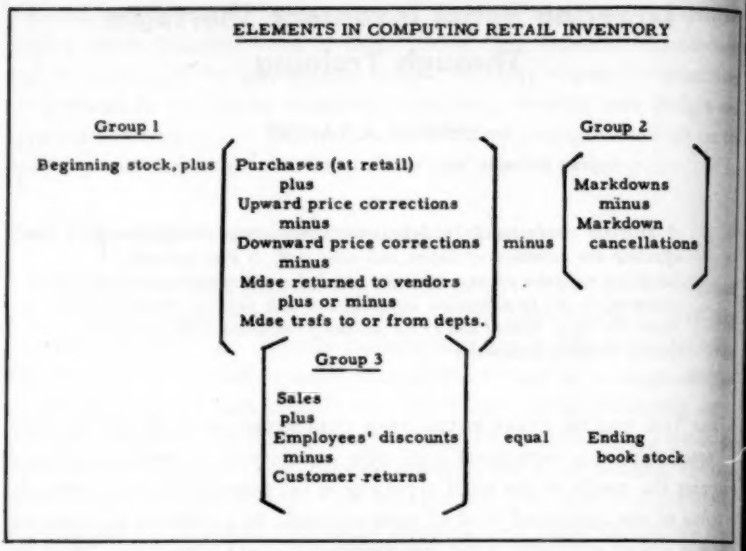


EXHIBIT 1

It is with our attempts to battle these elements of the shortage problem through use of an extensive training program that this paper will largely deal.

To comprehend the shortage problems of a large retail store and the need for such a training program, we need first to refresh our memories as to the techniques used to maintain the perpetual inventory records, and then briefly to examine these techniques in relationship to those who may adversely affect them.

Computation of the Perpetual Inventory and Errors Likely to Develop

Many will recall the formula used to compute inventories via the retail method, with all values in retail dollars, as described in Exhibit 1. (The segregation of the factors in this formula into three groups is for convenience of reference). The flow of data necessary to permit computation of the ending stock figures through this formula is funneled to the statistical section of the controller's office where inventory records are maintained on a weekly basis for each department, as well as for the entire store. The sources from which this data is derived and some of the common errors likely to develop may be related to the three groups of factors involved.

The elements in Group 1 come from accounts payable. Each item in this group is separately posted to a departmental purchase journal. This record can be correct only if the receiving and marking department has carefully verified

that the quantities have been correctly stated and that the price tickets placed upon the merchandise are in agreement with the details appearing on the documents. The perpetual inventory will also be wrong if the accounts payable section fails correctly to extend and foot the details on the documents. Finally, if a document is posted to a departmental purchase journal incorrectly, a shortage (or overage) will be created.

Group 2 concerns documents received directly by the statistical section from the receiving and marking department. The statistical section extends these documents, and posts the totals to the departmental records in summary form. Numerical controls are maintained in order to assure accounting for all documents. The Group 1 comments with respect to the need for accuracy as to extensions, physical quantities, and marking of the merchandise are equally applicable here.

Information as to Group 3 items are made available by the sales analysis section after all sales checks and sales register tapes submitted by the department, have been examined and summarized. If the sales clerk failed to sell the merchandise at the correct price because she made a guess when there was no price tag on the merchandise or misread the price tag or charged the customer for one item when two were in the package or failed to make a record of the special discount given to an employee or rang the transaction on the wrong department key, the figures computed in the sales analysis section will be incorrect and shortages will result. Then, too, even if the sale is recorded correctly on the sales floor, great care is necessary in order to assure that the members of the sales analysis section accurately interpret and record the data given to them.

Thus, there are many specific things which can (and often do) go astray in connection with this relatively simple formula and there are many people who may adversely affect these factors. Hence, the problem of accurate records becomes most complex and the need for an adequate program of training becomes imperative. It is the purpose of such a program to secure an awareness of the shortage problem at each level of responsibility, from the lowest up, and to remind each person, from time to time, of those things which should or should not be done in his particular job, if shortages are to be minimized. An illustration of the magnitude of the problem with which we are dealing, is presented in the manning table (which is typical of a medium-size store) shown as Exhibit 2.

Buyer's Responsibility and Training in Shortage Control

Where does the buyer and his assistant fit into all this? So far, we have said little or nothing in regard to them. Yet, without a doubt, the type of job done

ILLUSTRATIVE MANNING TABLE

	* REGULARS	** XMAS TEMPORARIES	*** XMAS PEAK
Selling	600	300	900
Receiving and Marking	45	10	55
Sales Analysis	10	5	15
Accts. Payable	12	2	14
Statistics	4	–0–	4
Buyers and Assts.	100	–0–	100
Total Work Force directly influencing perpetual inventory records	771	317	1088
Other employees (including leased departments)	629	83	712
Total work force	1400	400	1800

* Includes 200 extras working only 2 days per week.
** Includes 200 extras working 2 days per week.
*** Xmas peak included 400 extras.

EXHIBIT 2

in this area of management is the most important single factor in controlling the shortage of each department. The ability of buyers to understand the vast amount of paperwork (consisting of 50,000 merchandises invoices and 4,000,000 sales transactions in a major store in a medium-size city) and its relationship to the basic formula used to compute the perpetual inventory, plus the further ability to convey this understanding to those working with them, is essential if any program to prevent shortage is to succeed. Only day-to-day contact with the problems and the employees in each department, can prevent situations from developing which will create shortage. The buyer and his assistant are the only ones who can adequately provide this contact. Accordingly, first and final responsibility for shortages rests with the buyer. Logically, then, our shortage prevention training begins with him. This training begins as soon as a new buyer enters the store. All newly-employed buyers, no matter what their previous experience, are required to spend two days in the accounting department and two days in the receiving and marking department, observing work and procedures in action and discussing with the supervisors the problems of each of the divisions of these departments. Specifically, the supervisors and sections observed by the buyer are as follows:

1. Accounts payable (including order checking and vendors' adjustments).
2. Sales analysis.
3. Statistics.
4. Inventory shortage auditor.
5. Receiving and marking.

In addition, a general review of those problems and procedures which are in need of special emphasis is held for each buyer with the controller or his assistant. As a part of this review, a booklet containing a number of key procedural memoranda and instructions is discussed and given to the buyer for his permanent possession. Among the items included in this booklet is a comprehensive memorandum concerning the elements which will enter into the computation of the perpetual inventory figure for each department and what should be done to make sure that the books and records of the accounting department accurately reflect the activities of the department. This particular write-up is entitled, "The In-go and Out-go of Your Retail Book Inventory." A few of the suggestions to the buyer contained in it are as follows:

1. Verify that final net sales reported for the week bear a reasonable relationship to the memorandum figures accumulated daily on the sales floor.
2. Check the departmental purchase journal sheets so as to assure that invoices belonging to another department have not been included. In this connection, it is a required procedure that each buyer maintain a log of merchandise invoices approved for his department and to then check this log as the invoices appear on the journal sheets.
3. Establish the reasonableness of the mark-on per cents for each invoice appearing on the departmental purchase journals. An unreasonable mark-on per cent is quite possibly the result of an incorrect computation of the total retail price applicable to the invoice.
4. Advise the statistical section if the weekly report of markdowns or employee discounts does not appear reasonable.

After this beginning training, the new buyer is given the same follow-up training as the older buyers. This training consists of the following elements:

1. Weekly memoranda distributed from the controller's office on a store-wide basis. These briefly discuss various inventory problems of general interest.
2. Quarterly check-lists for use by each buyer, in order to provide assurance that important elements of the buyer's shortage prevention activities have not been forgotten. (This check list is completed and returned to the inventory shortage auditor for review.)
3. Departmental inspections conducted by members of the controller's office for the purpose of highlighting to the buyer any situations existing, which might encourage shortages.
4. Billboard type of cartoon posters, placed at strategic locations for the purpose of creating shortage consciousness.
5. Meetings and booklets explaining the problems and procedures necessary to provide assurance that the end-of-the-year inventory is taken accurately and that the "cut-offs" are correct.

Training Salespeople to Prevent Shortage

Certainly the next most important group capable of creating or eliminating shortages are the salespeople, themselves. Arranging for adequate training of this group is particularly difficult in view of the substantial turnover and radical expansion and contraction of the work force occasioned by the seasonal factors inherent in the retail business. (Sixteen per cent of the total business is done

in the period between Thanksgiving and Christmas, which is only eight percent of the year.) As previously indicated, the buyer and assistant buyer are in the best position to train the salespeople to prevent shortage. Responsibility for the effectiveness of this work must, in the final analysis, largely rest with them. However, to assist in the conduct of this training the weekly inventory-shortage bulletins often contain check-lists and other data suitable for use by the buyer when reviewing inventory shortage problems with his salespeople. In addition, the work of the buyer is supplemented by the following activities:

1. The personnel office includes a limited amount of shortage-prevention training in the introductory training program for new employees.
2. After new employees have been on the job for about a month, the inventory shortage auditor arranges to give them a short lecture and an illustrated booklet in regard to some of the basic problems which may create shortage.
3. The lead salespeople in each department are given a refresher lecture on inventory shortage problems. (Actually, this consists of a more mature presentation of the data used in the lecture to the new employees.)
4. A special playlet, prepared to dramatize inventory shortage problems, is presented to the salespeople during the Christmas bulge. This playlet is coordinated with special training sessions conducted in each department by the buyer.

The Three Essentials of Shortage Control Training

The programs that have been outlined for the buyers and the salespeople contain three elements which we believe to be essential for maximum success in this undertaking. First, these programs are conceived so as to be both perpetual and continuous. Second, although the programs are intensive in scope, the emphasis for a particular memorandum or meeting is on brevity and simplicity. In the third place, personal contact, to the greatest extent possible (either on a group or individual basis) is substituted for impersonal memorandum. In fact, one of our greatest fears is of the memorandum well-prepared but never read. Due to various limitations, we have not always achieved these three goals to the degree that we would like, but they represent objectives by which we measure our progress.

Possible Extensions of the Program; Best Environment for It

Our program is also regarded as incomplete as yet, in that it does not cover people working behind the scenes, such as the wrappers and packers, the delivery room, and the receiving and marking room. So far, our work in these areas is largely limited to procedural audits. Beyond that, we are relying upon the individual supervisor to do the required training. We feel we should be helping these supervisors in the same ways that we help the buyers, but all such

programs are a matter of evolution and must be developed on the basis of need. So far, this part of the program has not appeared to be as urgent as the parts which have already been described. Some day, nevertheless, we expect to be working with these sales supporting people on the same basis as the rest of the store.

What is the place of a training program in the overall scheme of things? Certainly, all the problems of inventory shortage will not be solved by a training program, no matter how well devised. In fact, it is quite likely that such a program will be doomed to failure if it does not exist in an environment of vigorous interest on the part of the top levels of management, and this interest should be continuously and aggressively transmitted to all supervisory levels. In addition, the program should rest on a foundation of systems and procedures which have been carefully designed to assist in the development of orderliness and good habits. Periodic reviews of these procedures should be made, in order to make certain that they adequately meet the ever-changing needs of the organization.

Given this well-balanced program, the shortages created by carelessness and ignorance can be minimized, though, at best, the road to success in this endeavor, will be found to be both long and difficult and, as is usually the case with such matters, many unforeseen disappointments will clutter the path. However, by the successful application of a program similar to that which has been described, the perpetual inventory records will become more accurate and therefore more useful, better habits in the physical handling of merchandise and documents will be developed throughout the organization, and from these an overall improvement in the profit picture may be expected.

What Do Executives Think Depreciation Is?

by ROBERT G. JAMES

Presently with the United States Government

The contribution of this article lies in at least an indication that not even accountants regard depreciation as having the nature of amortization of cost, however faithfully they hold, for practical purposes, to this method of charging it. The research study from which the material for the paper is drawn also suggests that other executives seem to exclude cost "recovery" as a proper concept of depreciation and have varied other ideas of it.

THE EMINENT BRITISH ECONOMIST, J. R. Hicks, has maintained that depreciation and certain related concepts are "not logical categories at all; they are rough approximations, used by the businessman to steer himself through the bewildering changes of situation which confront him."[1] There is a great deal of validity in such an observation. The businessman operates in an economy marked by unpredictable changes in prices, replacement costs, production rates, technology, and consumer preferences. He realizes that, through wear and tear or obsolescence, each of these changes must influence, in some degree, the cost of capital consumed in the productive process. Yet it is true that the businessman, out of necessity, calculates depreciation in a manner which only roughly takes into account the "bewildering changes" mentioned above.

The various calculations used in making rough aproximations of depreciation are, on the whole, quite similar. They consist in the main of a distribution, according to some simple mathematical formula, of the historical cost of an asset over its life. But does the *concept* (or theory) of depreciation, as it is understood by businessmen, bear a close relationship to these calculations? It is the purpose of this paper to indicate that, while businessmen generally calculate depreciation in similar ways, they have quite divergent ideas about its nature.

These various concepts of depreciation may be listed as follows:

1. **Recovery of historical cost.**
2. **Recovery or maintenance of productive capacity.**
3. **Recovery or maintenance of competitive capacity.**
4. **Recognition and recovery of change in value.**
5. **Recovery of "real" investment.**

This article relies, for its background information, on a study made by the author at the Massachusetts Institute of Technology during the past two years. The portion of this study drawn upon here is that concerned with the various concepts and theories of depreciation held by the executives who were inter-

1. J. R. Hicks, *Value and Capital*, (2d ed., Oxford; Clarendon Press, 1946), p. 171.

viewed in the field work portion of the research. The principal purpose of the interviews was to obtain the reaction of the executives to a series of comparative annual financial statements. These statements were drawn up in order to give effect to alternative treatments of depreciation, i.e., as based on original cost, original cost adjusted for general price level changes, and original cost adjusted for price level changes of each asset. The data were presented to company officers and, in certain cases, other individuals (such as investment analysts) and then discussed with them. The interviews were kept informal and many of the questions asked by the author dealt with such subjects as the role of depreciation in dividend policy, price policy, and labor and public relations.

In the course of this research, fifty-two executives, including 34 presidents, vice-presidents and treasurers, and eighteen controllers and accountants were interviewed. No attempt was made to get a scientific sample of industry. However, the men interviewed represented eleven companies engaged primarily in manufacturing, two in distribution, and five in public utilities. The reactions of the fifty-two executives revealed ideas on depreciation running through all the five categories mentioned above. These reactions are tabulated below:

Concepts of Depreciation
Held by 52 Executives in 18 American Corporations

	Recovery of:					
	Historical cost	Productive capacity	Competitive capacity	Change in value	"Real" Investment	Total
Total	4	21	7	7	13	52
Accountants and controllers	4	5	1	5	3	18
Presidents, vice-presidents and treasurers	—	16	6	2	10	34

The remainder of this paper will be devoted primarily to an explanation and reconciliation of these various viewpoints on depreciation. It should be remembered that we are dealing with the purposes or concepts of depreciation, not depreciation methods or practices.

Recovery of Historical Cost

The amortized cost approximation of depreciation has been labeled by James Bonbright as "peculiar to accounting . . . hence sometimes called 'the accounting concept'."[2] Field studies have supported Bonbright's observation. For example, Solomon Fabricant, studying capital consumption under the auspices of the National Bureau of Economic Research, found that, of 125 companies

2. James Bonbright, *Valuation of Property*, (New York: McGraw-Hill Publishing Co., 1937), p. 183.

reporting in a survey, an original cost rate base was used by over 80 per cent, while most of the remainder used an appraised or revalued revaluation base.[3] The percentage using original cost would undoubtedly be higher today as assets which were revalued in the 1920's and 1930's are increasingly retired.

There can be little doubt but that allocation—or recovery—of historical cost is descriptive of both the official position and practice of depreciation accounting. When the chips are down and an attempt is made to break away from the cost allocation doctrine—for example when a corporation attempts, for annual report purposes, to include in depreciation an amount in recognition of increased replacement cost of long-term assets which are being worn out or exhausted in production—exception will be taken in the independent auditor's report. But does such practice, along with the sanction of "official" acceptance and long use, give us the right to label allocation of historical cost "the" accounting concept of depreciation? This examination of what is *said* about depreciation, that is, how depreciation is conceived of rather than how it is practiced, indicates that allocation of historical cost is only one of many concepts of depreciation held by accountants and businessmen.

In fact, out of the thirty-four corporate presidents, vice-presidents and treasurers interviewed, not one believed the aim or concept of depreciation was wedded to original cost. This was true even though practically every one of them was an executive in a company which, in practice, used a strainght-line-on-historical-cost method of allocating depreciation. The influence of Federal tax regulations is, of course, very strong in this respect. The response from accountants and controllers on this point was somewhat less indicative but, even in this group, less than twenty-five per cent held to a concept of depreciation based on original cost.

Recovery or Maintenance of Productive Capacity

Twenty-one of the fifty-two opinions were classifiable into a category of depreciation theory which we can call "recovery of productive capacity." This can be interpreted as a theory holding that enough funds should be withheld from income to insure that the "productive" or "service" capacity of the business could be maintained. Of the twenty-one responses falling into this category, five were from the accounting-controller group and were typified by this remark:

"Our firm is a going concern; we don't intend to liquidate and depreciation should replace the assets we use up in operations so that we are able to continue

3. Solomon Fabricant, *Capital Consumption and Adjustment*, (New York: National Bureau of Economic Research, 1938), p. 65.

our usual level of operations." (Assistant controller of a farm equipment manufacturing company.)

The remaining sixteen replies in this category were from the president-treasurer group. Two sample comments were:

"Depreciation should measure the using up of our capacity to produce electric power." (Vice-president of an electric utility.)

"The provision for depreciation is a means of relating the cost of the renewal of the productive facilities to income." (Treasurer of a small chemical company.)

Forty per cent of those interviewed spoke of depreciation in terms of productive capacity. Of that number, however, very few had given serious thought to the actual implementation of such a concept. For example, there was no discussion of the difficulties of measuring productive capacity, the definition of a "product" or the complications which would be introduced by changes in manufacturing technique. This was true even though several executives mentioned large changes in products and techniques since the end of World War II. It was not surprising, however, to find the stronger support for this concept among the line executives rather than the accountants, since the former probably conceive of business more in physical terms than do the latter.

It should be pointed out that those holding the productive capacity concept are well supported in the extensive literature on depreciation. This support is often overlooked. As an example, even though there is less unanimity among economists on the subject of depreciation than many accountants believe, a great deal of the economic literature on depreciation is in terms of maintaining productive capacity. Typical is the study and calculation of national income in which Fabricant and Kuznets of the National Bureau of Economic Research and George Jaszi of the U. S. Department of Commerce speak in terms of measuring income after provision for maintaining physical assets or productive capacity. The newer branch of economics dealing with input-ouput analysis does likewise.

Typical of many economists' comments on the general subject of depreciation is the testimony which Professor Sumner Slichter gave before the Joint Committee on the Economic Report:

". . . only after management has set aside enough of current income to maintain the productive capacity of the enterprise does it have funds which may properly be regarded as available for dividends, higher wages, or lower prices."[4]

4. U. S. Congress, Report of a Subcommittee of the Joint Committee on the Economic Report on Profits Hearings, 80th Cong., 2d sess., *Profits* (Washington, U. S. Government Printing Office, 1949), p. 48.

During the same hearing, Charles E. Wilson, then President of General Electric Company, voiced an opinion almost identical to Slichter's. Similarly, Sir Geoffrey Heyworth's comments at a Lever Brothers and Unilever Limited annual meeting in London are pertinent. He pointed out that ". . . if we were to rely only on our normal depreciation provision, we should fail, by this amount, to maintain the fixed assets necessary to continue our present scale of operation."[5] There was little doubt that Sir Geoffrey felt that the normal depreciation was not only inadequate but incorrectly determined. More comments in the same vein are to be found in recent annual reports of Crane Company, Libbey-Owens-Ford, Chrysler Corporation, National Steel Corporation, American Brake Shoe Company, and many others.

It should not be believed that support for the productive capacity concept comes solely from businessmen and economists who may be unsophisticated in current accepted accounting standards. The number of accountants voicing this concept is hardly short of amazing. Their comments include:

". . . the allowance (for depreciation) is clearly a cost of operation and the regulating authority should recognize the necessity of providing out of revenue for the maintenance of the business in the state of productivity at the end of the year equal to that at the beginning . . . accountants generally recognize that adequate maintenance of the property is a prior need to be met before there can be said to be any profits."[6] (Percival Brundage, partner, Price Waterhouse and Company.)

"It would serve to accomplish . . . what accounting seeks to do: namely, charge revenues with the cost, in terms of economic sacrifice or commitment, of plant capacity consumed from year to year. It would provide for treating as recovered capital the entire amount of revenues representing the recovery of the actual cost of plant capacity currently consumed." (Professor William A. Paton, speaking in favor of "current dollar" depreciation.)[7]

"In my opinion, the first purpose of an annual provision for depreciation is the recovery of the economic cost of the depreciable property consumed during the year. The economic cost is not recovered unless the depreciation is sufficient to maintain the service capacity of the plant." (Leonard Spacek, partner, Arthur Andersen and Company.)[8]

These opinions are not isolated ones, but are representative of the thoughts,

5. *The Times*, (London), August 27,1948.
6. *The Peoples Gas Light and Coke Co.*, Rate Proceedings before the Illinois Commerce Commission, Docket No. 38244, 1951, p. 37.
7. *Ibid.*, p. 51.
8. *Ibid.*, p. 59.

in whole or in part, of many accountants and accounting groups speaking for organizations, including the Institute of Cost and Works Accountants in England. It could probably be concluded that, although almost all accounting for depreciation is carried out on an original cost basis, depreciation or capital consumption is still most widely conceived of as a physical erosion of productive capacity.

Recovery or Maintenance of Competitive Capacity

Seven of the fifty-two executives interviewed voiced a theory of depreciation which could best be described as aiming to recover or earmark from revenues an amount which, if invested in the business, would maintain the firm's relative position in the industry. Presumably, this could be interpreted as maintaining durable assets at such a level in form and efficiency that the firm could continue to maintain its relative competitive status. American business has traditionally grown—or at least held its own—through retained earnings. When, because of high taxes and public and labor pressures against high earnings, it becomes more and more difficult to get tax-free growth funds through retained earnings, it is only natural that a depreciation concept will develop which allows for maintenance of competitive capacity through larger depreciation expenses.

Furthermore, this concept has support in economic theory. The economic theory of income in current vogue is the amount that a person (or corporation) can consume still leaving the person (or corporation) as well off as before. If "as well off as before" is interpreted as the same relative competitive status or earning power—which was exactly the understanding of the seven adherents to this theory—then their concept of the depreciation base is closely in line with that of these economists.

The executives' responses which were placed in this category were usually worded in terms of maintaining relative earning power or relative efficiency of assets in order that position within an industry would be retained. An example of these responses is:

"I believe our company should retain money from earnings to insure, at the least, that our machinery and equipment will be modern enough to enable us to retain our relative status in the industry. This should be done through depreciation, but of course, it isn't. If we don't, we are liable to go the way of the New England cotton industry." (President of a New England machinery manufacturing company.)

The maintenance of competitive capacity theory of depreciation has some standing in the literature on depreciation. An outstanding advocate of this

concept is Arthur S. Dewing, who, in his *Financial Policy of Corporations*, writes:

"The proprietors of the business do not ordinarily want the return of their investment in the form of cash; they want the continuing earning power of their investment . . . (this) is achieved only if the wearing and the aging parts of the permanent property are gradually replaced by new equipment, having an equal or greater earning power . . . to accomplish the purpose the annual allowances for depreciation based solely on original cost must be supplemented by additional allowances adequate to permit the accumulation of a fund through the years sufficient to defray the additional cost of new equipment of improved design even though the general price level has risen."[9]

Dewing believes this added depreciation (which he would segregate under a separate obsolescence charge) should definitely be an income deduction. His concept does not differ greatly from that of Sanders, Hatfield and Moore, who write:

"Broadly speaking, a plant should be maintained out of revenue in a state of efficiency corresponding to the normal progress of the manufacturing arts in that industry."[10]

Nor does it differ from that of Ben Morrell, Chairman of the Board of Jones and Laughlin, who testified before a Congressional committee concerning steel price increases:

"But are earnings, used as we must use ours, properly called profits? I consider the term illusory and deceptive. If funds must be retained and invested in plant and property to keep a business a healthy, going concern, they are certainly not profits to be distributed to stockholders."

There is considerable evidence that a great many businessmen do actually conceive of depreciation as recovery of an amount which is needed to maintain earning power. However, it cannot be said, as Dewing does, that, "depreciation, to the practicing accountant and to the business executive, is a procedure to recover from current earnings the original investment in the permanent property necessary to produce those earnings."[11] Actually, there is no question as to depreciation *practice*—which is original cost—but it is significant to note that practice followed deviates considerably from theories held.

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9. A. S. Dewing, *Financial Policy of Corporations*, (New York: The Ronald Press, 1941), p. 609.
10. Sanders, Hatfield and Moore, *A Statement of Accounting Principles*, (1938, American Institute of Accountants), p. 35.
11. Dewing, *op. cit.*, p. 609.

Recognition and Recovery of Change in Value

Seven of the fifty-two executives with whom the question was discussed spoke of depreciation in terms of a decline in value. Most of those using this concept came from the accountant-controller group. Generally they made comments such as this:

". . . depreciation measures the expiration in value of assets which must be recovered from income." (Depreciation accountant in an electric utilty.)

However, as each discussion proceeded, it became evident that the word "value" would have to be defined further. Sometimes it was said to be the "service value" or "service life" or "utility" of the depreciable assets which was meant by value. But a depreciation concept using such terms avoids the central problem of depreciation: a discussion of the measurement of what is to be depreciated.

The executives who chose to discuss depreciation in terms of a decline in value are supported largely in legal and regulatory opinions. The Federal Communications Commission has said that "depreciation, as applied to depreciable telephone plant, means loss in service value."[12] The National Association of Railroad and Utility Commissioners has spoken in similar terms. As is well known, most regulatory bodies interpret value as original cost. Further discussion of this problem with executives who started off by speaking of depreciation in terms of a change in value led the author to believe that the accountants and controllers among them leaned to an original cost interpretation of value, while the remaining executives felt value should be interpreted in physical terms.

Recovery of "Real" Investment

Thirteen of the fifty-two executives interviewed conceived of the proper role of depreciation in terms of a return of purchasing power of "real" investment. As one respondent put it:

"Depreciation as now calculated bears no relation to actual costs. To properly determine income a business should deduct real dollar cost from revenues. . . . This might be called replacement cost but I would call it the current purchasing power of the capital used up." (Treasurer of a retail drug chain.)

Another said:

"The aim of depreciation should be to recover the present day cost of capital

12. Federal Communications Commission, *Uniform System of Accounts for the Telephone Company*, 1935, p. 4.

goods used up in production . . . or obsolescence." (Vice-president of a telephone company.)

Even a casual reader of today's accounting literature will find widespread support for this concept of depreciation. George O. May believes that "railroads and public utilities should . . . be required to provide for property exhaustion on the basis of cost, adjusted for the change in purchasing power of money."[13] Dwight Billings, controller of Pacific Mills, testifies, "In a period of inflation it is manifestly unfair to restrict the earnings of the company to a percentage of that original cost, unless the percentage is adjusted upward as costs rise."[14] William Blackie, Vice-president of Caterpillar Tractor writes that depreciation should deal with "current money cost of the original investment from time to time as it wastes away."[15]

Among economists, George Terborgh, Research Director of the Machinery and Allied Products Institute, and Theodore Yntema, Economist of the Ford Motor Company, apparently follow recovery of real investment theory of depreciation, as may be seen in Terborgh's testimony in the Peoples' Gas and Electric hearings and Yntema's testimony in the Illinois Bell Telephone Case—both heard before the Illinois Commerce Commission.

At all events, twenty-five per cent of those interviewed, in the survey, including one-third of the president, vice-president and treasurer group, believed a correct concept of depreciation most nearly approximated a recovery of "real" investment. This group was well aware of the theoretical background of their concepts, which has been widely publicized in accounting journals, legal cases and government hearings. Several of the companies represented by these executives had undertaken studies of index number revision of depreciation allowances. However, there were wide divergences as to the type of price index which should be used in converting original costs into "real" cost terms.

There was also confusion as to whether the "real" costs calculated from index number adjustments would be equivalent to current replacement costs. In only a few cases was it recognized that adjustment of original costs by means of an index number of prices specific to a given type of assets, would not necessarily yield an adjusted cost equivalent to recovery of productive capacity, because an index number series is based on relative prices of an identical good in a series of years. However, the productive capacity which businessmen wish

13. George O. May, *Business Income and Price Levels—An Accounting Study*, (New York: Study Group on Business Income, American Institute of Accountants, 1949), p. 66.
14. *Profits, op. cit.*, p. 17.
15. William Blackie, "What Is Accounting Accounting For—Now?" *N.A.C.A. Bulletin*, July 1, 1948, p. 1349.

to see maintained is, generally, the current productive capacity of a modern machine rather than one which has been available over the period to which a price index series may refer.

Those interviewed who believed that "real" cost depreciation could best be accomplished by adjustment of original cost with a general price index seemed to be on firmer ground. The argument used by several of these executives was based on the assumption that a given investment in a company was made at a time when it had a corresponding command (purchasing power) over a given group of goods. It was then pointed out that the aim of income measurement and therefore depreciation, is to maintain this command over goods *before* claiming that profits have been realized.

There's General Disagreement on the Nature of Depreciation

This paper is designed only to present findings as to what some executives think depreciation is. No attempt has been made to prefer one concept of depreciation over another (other than to point out the theoretical bounds of some of the concepts). Nevertheless, there may be real significance in the revelations here offered. It may well be important that the understandings of the nature of depreciation, evidenced by a reasonably representative group of business executives, should diverge so markedly from each other and from the concept on which prevalent depreciation practice rests. This perhaps suggests the principal reason why depreciation accounting remains an unsettled and controversial subject.

Is Optional Depreciation The Answer?

by ROY B. OLIVER

Chief Cost Accountant, Schlage Lock Company, San Francisco, Calif.

The unmistakeable impact of income tax law and regulations relating to depreciation, on equipment replacement policy is noted at the start of this paper which then turns to three alternatives which have been proposed. The author finds acceleration of cost-basis depreciation and use of replacement-value depreciation equally unacceptable but strongly urges substitution for present practice of rates set by the taxpayer in line with his knowledge of conditions under which depreciable assets are employed.

OUR NATION HAS EARNED the reputation of being progressive because of an immense industrial capacity made possible by continued technological progress. Continued progress and leadership as a nation depends largely on our ability to maintain an economic climate favorable to keeping America's vast industrial plant completely modern and up-to-date. Certain aspects of our tax structure are working against this modernization and technical advantage which we have maintained for many years. To be specific, depreciation allowances for tax purposes are operating to jeopardize our industrial ascendancy. They are encouraging the retention of obsolete plant and facilities of all types. As such, they are inimical to the best interests of our country.

How Inadequate Allowances Hold Up Industrial Progress

Outmoded depreciation rules and rates, quite deeply entrenched in the Internal Revenue Code, prevent the release of adequate depreciation reserves. Industrial plants are presently laboring under a tremendous financial handicap to replace outworn and outmoded plant and facilities in spite of the availability of new and better equipment. They face this handicap because taxes must be paid on profits which are not actually profits. Under present regulations we must, perhaps, depreciate a piece of equipment over twenty years. By that time, we will have accumulated in depreciation reserves, a sum equal to the purchase price of twenty years ago. Aside from the fact that we must double this amount from profits after increased corporate taxes to replace the equipment, we must, in the meantime, use equipment which is obsolete long before it is twenty years old. In fact, today, many production tools are obsolete in five to ten years. New equipment is constantly being made which will do jobs better, faster and more cheaply.

In spite of that fact, we often defer

the purchase of better facilities because of the provisions in the tax laws. Here is how it works: the plant production manager and accountant have figured that by replacing an old machine with a new 1953 model with all the improvements, a saving in direct labor can be realized which will pay for the new machine in three years. The additional saving in better work flow, indirect labor, better quality, while recognized as a definite advantage, is not considered as a factor in the computation. Consideration is given adverse elements, such as cost increases in personal property taxes, larger depreciation reserves, and additional capital investment. These disadvantages are small in comparison to the savings in direct labor, so a strong recommendation is made to purchase the equipment. The matter, in due course, reaches the company's chief financial officer for a decision. He embarks on a different course of reasoning than that of the plant manager and accountant. His thinking is based on taxes and the availability of capital for investment. It runs something like this:

1. Only a portion of the old machine cost has been recovered through depreciation, since the machine has been arbitrarily determined to have a useful life of twenty years.
2. The new machine will cost twice as much as the old one, partly because of improvements in method and design, but mostly due to inflation.
3. Under present tax laws, the increased cost of the new machine must come out of earnings after taxes.
4. For every $48 to be spent in acquiring new facilities, the company must earn $52 to pay income taxes.
5. There are certain significant questions to answer, examples are: Can we use the money to better advantage? Can we "get by" with the old machine for another year?"
6. It seems right, therefore,—however, reluctantly—to recommend that the proposal be held up until a more favorable financial picture justifies the transaction.

The net result of this executive reasoning and the factors behind it, is that direct costs continue high, repair and maintenance costs increase and marked obsolescence sets in. Carried to its ultimate conclusion for all plant and equipment, this example means that the enterprise will gradually lose ground and will underwrite increasing plant costs until it loses its competitive position or goes "broke."

Absence of Effective Protest

One would think that such a situation would raise a hue and cry from industry, but such is not the case. Industry, as a whole, remains complacent, continues to accept stringent depreciation rates, amortizes its present equipment on a low cost pre-war basis, and buys what new equipment it can afford at prices from 85 per cent to 110 per cent higher than pre World War II costs. ("Handling Higher Replacement Costs" National Industrial Conference Board, July 1950.) The reasons for this complacency are as follows:

1. Abnormally high earnings during the past decade.

2. Failure to recognize the adverse influence of tax restrictions upon equipment purchase programs.
3. The relative absence of stiff competition in recent times. (a condition which is rapidly changing.)
4. The failure of industry to unite in a campaign to liberalize depreciation provisions under the Federal income tax laws for corporations.

A few isolated groups have shown some articulateness, of course. Companies with high capital investments in relation to earnings have been particularly hard hit by the depreciation provisions of the tax laws. Machine tool manufacturers have been alert to the dangers in the laws and have vocalized their objections. However, by and large, their cries have been lost in the wilderness.

The Manner In Which the Situation Developed

As a matter of historical record, it appears clear that the output of capital equipment has been an important factor in raising the plane of living in the United States. There is a parallel between per capita income and per capita capital equipment as represented by the production of construction materials and durable goods. The rise in real income is a direct result of increasing mechanization and the effect of mechanization upon the productivity of the worker. The existence of capital equipment facilitates the process of production. Machinery and technology permit the minute specialization that is characterstic of today's industry.

The original concept of depreciation of capital equipment rests on this historical record. This concept permitted the recovery of its cost over the normal useful life of the asset. The depreciation reserve became the very life blood of continuing mechanization, as it enabled the owner to recover his investment from outworn and outmoded equipment and re-invest it in new and better equipment. In line with this, prior to 1934, taxpayers were free to determine the useful life of their capital equipment. Depreciation deductions on income tax were allowed as an item of expense unless the Treasury could prove the deductions to be unreasonable. The burden of proof was on the Government. In 1934 there was especial need to raise revenue. T. D. 4422 was issued, which put upon the taxpayer the difficult burden of proving at the time of purchase, the profitable and useful life of machinery and equipment.

Since no one could offer such positive proof in advance, the Bureau of Internal Revenue (now Internal Revenue Service) undertook to decide the length of "useful and profitable" life of equipment, in order to set up depreciation schedules for tax purposes. To carry out T. D. 4422, the Bureau issued the first edition of Bulletin F, "based on studies" made by the department in 1931. These studies reflected the replacement policies in

effect previous to the depression years, when the replacement of machinery and equipment was slow and the manufacture of new equipment was considerably below normal. They did not take into consideration, then or later, that, as the nation recovered from the depression, industrial companies entered into a new phase of research and development. Ideas for machinery and equipment rapidly developed and the obsolescence of present usable equipment became increasingly obvious. The "useful and profitable" life of equipment has been shortened. However, the government had, in the meantime, discovered that long-term depreciation schedules were yielding increasing tax revenue. So, instead of shortening depreciation schedules in line with industrial developments, they were lengthened in the 1942 edition of Bulletin F. The depreciation period for a turret lathe, for example, was raised from 16 years (1931 edition of Bulletin F) to 25 years.

Some Proposals for Relief

Critics of this policy have reasoned that such action on the part of the Government is no longer necessary, that it had served its purpose in depression years, and Federal revenues will not suffer, in the long run, if industry were allowed to select its own rates of depreciation. On the contrary, it may well be that government income would increase, as industry would yield bigger profits as facilities were allowed to expand and produce. These critics contend that, as long as the taxpayer consistently applies depreciation schedules and does not write off more than the total cost, the Treasury Department has little cause for alarm.

Out of the welter of discussion and writing have come three major proposals for relief from the present situation, the first two of which will be examined here before giving desired attention to the third:

1. An accelerated rate of depreciation should be allowed.
2. Replacement costs of equipment should be substituted for original cost as a depreciation base.
3. Greater taxpayer discretion in determining depreciation rates and methods of writing off assets should be permitted.

Accelerated depreciation is not the remedy. This method contemplates the recovery of a good portion of invested capital over the early life of the asset. Advocates contend that it would provide an incentive to invest in new facilities and that this stimulus would build up income sufficiently to add to tax collections. Accelerated depreciation escapes the general criticism which has been levelled against other plans (such as replacement costs depreciation) in that it is based upon cost. The amount which can be charged against revenues cannot exceed the cost of the asset. However, it presupposes no change in the rate of depreciation currently allowable. It merely accelerates the yearly charges

in the first part of the life-period fixed by law. It assumes that the asset will be kept in operation longer than the time for actually writing off depreciation costs. As a result, net income from the particular asset will be high in later years of its life, compared with its early years. Under this method, income will be shifted from the early years of the asset to the later years, but the rate of useful life is not changed to the actual conditions of usefulness.

As an illustration, suppose an asset with a 10 per cent rate costs $100,000 as purchased. Under normal depreciation, $10,000 a year will be charged off for ten years. If accelerated depreciation is used to write off the asset in five years, then $20,000 per year will be charged for five years, lowering income in the first five years of the fixed span of life. In the latter five years, no depreciation will be charged, increasing income. The only change that takes place is a 'bunching up' of income in the last five years. The result of accelerated depreciation would thus be to make computed income fluctuate violently over the lifetime of assets. It is possible that some harm could result from such fluctuations in income. If the tax rate went higher after the asset had been written off, industry would be penalized. Another complication might arise, relating to negotiation by unions for higher wages. If the negotiations took place during any of the last five years of the asset life, union representatives might point to the high profits being currently earned, as proof that higher wages were justified. Little or no account of the low earnings of the preceding five years would be taken.

Hence, from the standpoint of the right use of depreciation on the principle that it represents recovery of costs over the useful and productive life of an asset, accelerated depreciation does not measure up as an effective tool, for it still uses the premise that all equipment of like nature has the same useful life, without regard to its actual use or particular circumstance. It still presumes that a government agency, far removed from the many peculiar problems and circumstances involved in the industrial life of any assets, can accurately determine the period of life over which capital should be recovered.

Proponents of replacement value as a depreciation basis contend that companies should be permitted to recover the purchasing power represented by the original expenditure. To do otherwise, results, in their opinion, in inaccurate statements of net income and in reported earnings which are illusory in character. It is pointed out that profits thus overstated lead to demands for higher wages, higher dividends and lower prices, and that, if these

demands are met by fictitious profits, they constitute distributions out of capital, contrary to the interests of the corporation. It is suggested that price indexes prescribed by the Internal Revenue Service for estimating higher values, be used or that new properties be set up on the basis of present-day valuations and depreciation taken on the basis of these written-up values.

On the other hand, it should likewise be pointed out that replacement value as a depreciation base does not have the sanction of the accounting profession, Securities and Exchange Commission, or the Treasury Department. Any value other than original cost for depreciation purposes is looked upon as "not according to good accounting practices." The weakness of the replacement value depreciation plan is that replacement costs are future costs. No one can accurately forecast the future trend of plant and equipment costs. It would seem to be rather difficult—to say the least—to work out an effective accounting system which would accurately recover exact future replacement cost when no one can forecast such costs accurately. Writing off depreciation at original cost over a known period of time gives a measure of definiteness to as least one segment of costs. Reflecting depreciation on fluctuating values would lead to confusing and meaningless financial statements. The usefulness of comparative, historical earnings data would be destroyed. (This is convincingly presented in "Conventional Depreciation Allowances vs. Replacement Cost," by Economics Professor Robert Eisner in *The Controller*, November 1953.)

Optional Depreciation Is The Answer?

The third alternative to the present set-life and set-rate depreciation practice is optional depreciation. By optional depreciation is meant greater taxpayer discretion in determining the useful life of an asset. It is a return once again to the freedom of selecting individual rates of profitable life, based on the particular use and environment of each asset. Prior to 1934, American business enjoyed the benefits of this realistic practice to an important degree. It was removed only as an expedient to increase government income in depression years and was never restored after the need for the change to exist. It recognizes that the "useful and profitable" life of machinery or equipment can never be arbitrarily established without consideration of manufacturing facts or specific operating circumstances. For example, a punch press 10 years old may be still operating profitably on certain types of work but is costly and obsolete on other types of work. A drill press may be still working satisfactorily aften ten years on one shift, while the same type of press doing

heavy duty on three shifts may be worn out in three years. Machine performance required to make a precision part for one product may be far more exacting than for other parts requiring less accuracy.

Such circumstances could be cited endlessly. The central point is that the length of profitable and useful life depends on individual circumstances applicable to the individual machine. Only the owner of the machine knows these circumstances well enough to sum up their effect in a suitable estimate. In short, money spent for machinery, plant and other equipment is risk capital. A basic principle in the employment of risk capital is that the risk should not be extended beyond the period of the foreseeable future. The capital should be recovered during the probable period of the risk—a principle recognized by the Government in time of war in the issuance of certificates of necessity. Only the buyer of new equipment is in a position to estimate the probable period of risk.

Optional depreciation is the most logical solution to the whole depreciation dilemma. The taxpayer would be allowed to write off actual acquisition costs as depreciation on a reasonable and consistent basis. Any attempts to write off assets too rapidly without just cause would result in its rejection by the Internal Revenue Service. Further, the taxpayer would have no logical reason for doing so, as he would distort his costs and would have little or nothing to deduct for tax purposes in future years. Generally speaking, a pattern of rates would be devised in each firm, based on experience, which would become a reasonable and consistent basis for setting of new rates. It is a pleasant thought that permitting companies to choose their own rates of depreciation would terminate all futile and needless controversies occasioned by trying to enforce the present depreciation schedules, a costly process for both Government and business.

Action Over-Due

Fortunately, the Congress is beginning to realize that our present depreciation rules have led us into a dangerous economic position in today's world markets. Wholesale obsolescence is threatening to set in. It has seen that Canada, England, France, Germany (and even Soviet Russia) have changed laws affecting depreciation, to enable recovery of capital investment fast enough to attract large quantities of risk capital investment in new plant and equipment, which will produce goods faster, cheaper and better. ("Effect of Depreciation Policy" National Industrial Conference Board, 1950.) Although tax legislation now pending does not contemplate optional depreciation, let us hope, from the standpoint of national interest, that

the interest in liberalized depreciation allowances will not wane. They are of the utmost importance to national defense and the advancement of the American way of life.

A return to mutual trust and confidence among Government and businessmen is needed. When this occurs, more profit will be made and more revenue will be produced for the Government. Only the men in business who are employing plant and facilities for a particular purpose know the rate at which their capital investment should be recoverd. They should be allowed to exercise their integrity and judgment to the end that, in the world of tomorrow, we may continue to point with pride to America's industrial leadership.

Using Replacement-Value Depreciation in Costs

by R. K. MIRRIELEES

General Accountant, The Diamond Match Company, New York, New York

By methods readily available to all companies, if they have also available replacement as well as original cost of their equipment, the company which furnishes background for this article matter-of-factly employs replacement value depreciation in its costing, adjusting the results for financial statement purposes. The entries are exemplified and advantages discussed.

OUR PAST EXPERIENCE and thinking relates amortization or depreciation to the original cost of the asset. We know that this is sound accounting as well as logical thinking, for we attempt to spread the cost of productive assets over their expected life. However, the experience of the past ten years of our business economy has shown that, when obsolescence makes it necessary to obtain new equipment, the dollar value of replacement cost may bear little relationship to original cost. During the last decade, depreciation reserves have been found far too small to cover the cost of new equipment or buildings. To correct this situation it is the duty of both the cost and general accountant to keep management informed of the variation between book value and replacement value. Such knowledge is of special importance in older concerns where many buildings and machines were built for a fraction of present-day costs. The method described in this paper provides a means of recording and reporting this difference between depreciation of book value and depreciation of replacement value, and also a way of keeping operating costs up to actual in instances in which the fixed asset has been fully depreciated.

At the outset, let me clarify the terms, replacement value and book value as used in this manuscript. By replacement value I mean the cost of reproducing an asset with equal production possibilities. Book value is the original capitalized cost of the asset. As accountants, we deal so much with figures that, in our thinking, values are fixed rather than dynamic. In this connection, the depreciation variance methods includes provision for measuring the increased obsolescence where the determination of the life of an asset may vary from that estimated at the time of the original purchase. This could be the tool which management would use to decide either to buy new equipment because of the increased burden of depreciation of the old, or to make plans for putting aside funds to aid in financing the purchase of new equipment when needed.

Deal Property Records for Cost and Replacement Values

The first step in planning to install a replacement depreciation variance method is the establishment of current values for fixed assets already on the books. This can be done either by the company or by a competent appraisal consulting firm. In either case, an asset ledger showing replacement value should be set up to conform with the asset ledger showing book value. This is important, in order to be able to determine the difference between book and replacement value depreciation for adjustment of profit statements. When the appraisal is made by the company, care should be taken to use data which is sound. Insurance companies are very helpful in this respect, for a study of this kind yields additional reward, because it brings to light cases where insurance values may also be too low!

Handling Replacement Value Depreciation in Costing Data and Entries

In order to clearly explain the device under discussion, it will be wise to use an illustration from our own experience. The example will be one of the departments in our plant and the application of this depreciation variance will be demonstrated, to show how it makes its appearance, how its effect is presented and, later how it is adjusted for profit and loss statements. The manufacturing department will be used to show our depreciation variance method from the point of establishment of replacement values until final completion of the profit statements for management. Exhibit 1 shows the type of asset record which we use to record replacement value and depreciation on it, and, also, in the lower part, the similar record on a cost basis. These are simplified illustrations. It will be noted that the replacement value is $1,360,000 or considerably more than the amount of book value. Depreciation charge at replacement would be $75,600, whereas book depreciation is $28,500.

In order to reflect our current cost of operation the standard costs for the department includes depreciation expense of $75,600 for the year. A standard journal entry is made on the cost ledger each month for 1/12 of this amount, or $6,300 per month. This journal entry is as follows:

Dr.	Work in process	$6,300.00	
Cr.	Reserve for replacement depreciation		$6,300.00

To record monthly depreciation of department equipment for the month of January.

The effect of this entry has already been anticipated in our standard cost as shown on Exhibit 2, which sets forth the budget for the department and which also shows breakdown of the standard cost of a finished product. This includes our replacement depreciation, taken into the departmental standards. Both these illustrations have been condensed to show the details pertinent for this discussion. The standard costs now reflect the present day dollar values of equipment used

DEPARTMENTAL PROPERTY RECORD—REPLACEMENT VALUE AND COST BASES

REPLACEMENT OR REPRODUCTION VALUES						DEPRECIATION EXPENSE			
Building	Equipment	Autos	Total	Insurance	Taxes	Building	Equipment	Total Annual	Total Month
$460,000	$900,000	$—	$1,360,000	$1,169	$5,621	$18,400	$57,200	$75,600	$ 6,300
								6,790	566
								$82,390	$ 6,866

Book Value				Depreciation Expense			
Building	Equipment	Autos	Total	Building	Equipment	Total Annual	Total Month
$150,000	$450,000	$—	$600,000	$6,000	$22,500	$28,500	$2,375

EXHIBIT 1

for production. The department has included $6,300 or 6.87 dollars per productive unit which has been added to other departmental costs to arrive at the finished product cost of $90.07, including $2.45 depreciation. The operation reports submitted to management are based on these standard costs. (The example used here does not involve a formula to determine the amount of credit which should be applied to the profit on the finished product to restore general accounting to a cost basis. This is done by obtaining a ratio which can be used for this purpose. More attention will be given to this later in the paper.)

When this initial handling of depreciation is effected on plant books, no further entry related to factory costs is made after the one already presented setting up replacement value depreciation. The reserves for replacement depreciation are listed on plant trial balances submitted to the main office for consolidation with other branch records. On the company books, the central office has made the following entry, setting up cost-basis depreciation:

Dr.	Depreciation variance	$2,375.00
Cr.	Reserve for depreciation	$2,375.00

To set up the depreciation on manufacturing department assets for the month of January.

When the consolidating office receives the branch trial balance, it treats the reserve for replacement depreciation as an additional favorable variance, and adjusts the factory total manufacturing variance accordingly. An alternative would be to make a journal entry on the consolidating office records as follows:

Dr.	Reserve for replacement depreciation	$6,300.00
Cr.	Depreciation variance	$6,300.00

To reverse replacement depreciation entry shown on branch records.

Either method will produce the de-

sired result, which is to remove replacement depreciation and substitute book depreciation. The variance so obtained is shown as a favorable one on the profit and loss statement.

When there are no separate plant books, the cost section of the general office would use the method initially illustrated to include the replacement value depreciation in the costs (and in departmental and product standards), as outlined in Exhibits 1 and 2. The entry would be made directly to the variance account:

Dr.	Work in process	$6,300.00
Cr.	Depreciation variance	$6,300.00

To record the amount of depreciation expense for the manufacturing department based on replacement value January.

The result is exactly the same as previously shown. The offsetting variance debit (or alternative reversal of replacement value depreciation) would be made on the general office ledger.

Reporting the Adjustment to Cost Basis Depreciation; Allocation to Lines

It was stated earlier that attention would be given to the means of eliminating from profit and loss depreciation in excess of that taken on original cost. Replacement depreciation included on Exhibit 2 was reflected there in the standard cost of $90.07 per ton of finished product item 2570 and the value of shipments is charged to cost of sales of this end product. A profit statement is prepared which includes cost at standard. At this point, cost thus includes the current cost of replacing equipment. To correct cost of sales to show the true profit per books (original cost basis), we disclose the (previously explained) favorable depreciation variance below cost of sales at standard as shown on Exhibit 3, a departmental operating statement. Here is the key to the usefulness of our procedure to management, on this basis since, in this way we show the executives our cost based upon new machinery as well as the excess in our depreciation.

Standard cost of sales based on historical cost is easily determinable by subtracting the depreciation variance in Exhibit 3 from the standard cost figure.

It has not yet been indicated how the depreciation variance is distributed when several products are made in the same cost centers. Exhibit 3 tells the story of a simple finished product which is the result of the work of several departments on product item 2570. Other products manufactured are not as simple inasmuch as they are the end result of processes in common departments and are called on Exhibit 4 products A, B, C, D, E and F. When the end-product has been made it cannot always clearly be identified as to the amount of replacement depreciation included in each product. As Exhibit 4 indicates we use percentages to apportion the favorable depreciation variance discussed before, to product lines. The figures

COST DATA GIVING EFFECT TO REPLACEMENT VALUE DEPRECIATION

(Departmental Budget)

STANDARD NUMBER OF UNITS 918

Account Number		STANDARD COST	
401	Direct labor	$ 5,484	$ 5.97
403	Salaries — wages — supervision	1,271	1.38
410	Indirect labor	4,111	4.48
434	Overtime premium	—	—
446	Felts	180	.20
447	Wires	150	.16
451	Cutters and knives	150	.16
452	Greases, oils and solvents	50	.05
453 thru 483	(Sundry accounts not involved in topic under discussion)	24,800	27.02
	Depreciation	6,300	6.87
	Total direct expense	37,012	40.32
	General plant	8,767	9.55
	Total expense	$45,779	$49.87

PRODUCT STANDARD

On Item No. 2570

		STANDARD COST PER TON
Material cost		$53.62
Conversion labor costs		16.03
Direct labor — mill		2.13
Expense	$15.36	
Depreciation	2.45	
Warehouse and shipping	.48	
Total expense		18.29
Standard cost per ton of Item #2570		$90.07

EXHIBIT 2

shown here provide a background for explaining the use of the distribution table.

We will assume that Plant A has included in standard cost $20,000 for the month of January for buildings and equipment at replacement depreciation value. The general office has set up $8,000 for actual depreciation for January, giving a favorable variance of $12,000 to be applied to the product-line operating statements. Since this depreciation has been absorbed departmentally, there is no direct relationship with the product standard cost as there was in the case of the manufacture of item 2570. The percentage rates for Exhibit 4 are arrived at by reviewing the departmental standard cost budgets (similar to that shown in Exhibit 2.)

Let us assume that we have five de-

REPORTS ON OPERATIONS FOR JANUARY
(Tons produced 2,000.00)

Sales	$100,000
Returns	2,000
	98,000
Less:	
Freight	500
Discount	1,500
Total	2,000
Net sales	96,000
Cost of Sales at standard 1000 Tons at 90.07	90,070
Less: Depreciation variance	3,925
Manufacturing variance	1,375
Cost of sales (Actual)	84,770
Gross profit	11,230
Selling expense	2,210
	9,020
General and administrative expense	1,200
Net Profit	$7,820

EXHIBIT 3

partments in the process of producing the products listed on Exhibit 4. From each departmental budget, we obtain the projected level of activity by products and, using these figures, we apply the unit rate of depreciation expense. Our result is the proportionate dollar amount of depreciation sustained by each product in that particular department. Each of the five cost centers is reviewed in this manner and a summary prepared listing replacement depreciation departmentally in columns for each product and in total. The footing for each product, divided by total depreciation, gives the percentage for Exhibit 4. The process is repeated for each plant, in order to allocate the depreciation variance to products on a plant basis. The excess of replacement value depreciation over cost basis depreciation ($12,000) is then allocated to products based on the percentages shown. This separation allows management to weigh individual product performance in relationship to fixed assets.

Better Costs for Management

The information provided by Exhibit 3 and available by lines through Exhibit 4 is used as a tool to measure

Distribution Chart for Excess of Replacement-Basis Depreciation Over Cost-Basis Depreciation

PRODUCT	PLANT A	
	Per cent	Dollars
"A"	17.60	$2,112.00
"B"	14.73	1,767.60
"C"	31.72	3,806.40
"D"	7.49	898.80
"E"	.61	73.20
"F"	27.85	3,342.00
Total variance	100.00	12,000.00

Exhibit 4

how efficient our plants are compared to our competitors. Many a plant today shows satisfactory cost performance merely because its building and equipment has been fully depreciated and no expense is charged in the budget. However, where costs contain replacement value depreciation, a poor performance record stands out upon comparison with industry averages. Management is provided with a basis for retaining earnings in surplus as a safeguard for the day when replacements will have to be made. The decision to do this rests entirely with executives but they are in need of all available information to enable them to foresee the future expenditures which may be required. The depreciation variance method also enables the sales division to give effect in sales price to fixed assets replacement needs. This is an important point, because a low rate of book depreciation can very easily mislead management into thinking that prices and profits are sufficient when no provision is being made for the obsolescence of the buildings and equipment.

Another measurement which can be made is the efficiency of the equipment. When standard costs are increased to include in product costs current reproduction expense of the machine and buildings, reduced costs suggesting increased productivity do not ever mean that low or lapsed depreciation have created fictitious results. By relating cost of sales at standard to known statistics, management can often determine whether or not new machinery should be purchased, based on published reports of other companies in similar industry. Again, it would be well to point out that this factor could be easily overlooked where original cost value depreciation is used and where automatic machinery is a big factor in costs.

In this connection the facts shown in Exhibit 3, if they bring about a change in pricing policy and a result-

ing increase in profits, will make it apparent to management that provision should be made for future replacement.

Adjusting Inventory to Cost; Replacement Cost of New Equipment

The distribution of the excess of replacement value depreciation over cost-basis depreciation was taken up earlier. It results in profit and loss statements on original cost. We also need to adjust standard cost to give an inventory price to be used in calculating finished goods inventory at historical cost. In the case of end product #2570, standard cost for use during the year was $90.07 (Exhibit 2) but, at year-end, the inventory would be reduced by the rate of depreciation variance per ton. This rate would be obtained by dividing the number of tons produced into the favorable variance. For example, the the rate derivable from Exhibit 3 is $3,925 ÷ 2,000 tons of $1.96 per ton. Inventory price should be $90.07 less $1.96 or $88.11 per ton. The entry called for by the example is as follows:

Dr.	Depreciation variance 1,000 tons inventory at $1.96	$1,960.00
Cr.	Inventory of sulphite pulp	$1,960.00

To adjust inventory to reflect the actual cost of manufacture at the end of the accounting period.

Adapting the Procedure to Small Business; Its General Benefits

For small businesses, in which the procedure here described is not easily given effect to in full, the theory of it can be applied to the financial statements after their completion. The easiest way in this case, is to obtain the increased cost factor of the fixed assets and multiply depreciation by this factor. This increased depreciation can then be used to increase the unit cost of the finished goods. Every comparison which has been discussed in the preceding method can be used with this replacement factor.

The value of our depreciation variance method of bringing standard costs up to date has been proven in the last six years. Inefficient and costly operations are no longer hidden by low book depreciation expense. Another important gain has been the availability of factory costs which are comparable and the substitution of more productive new equipment for obsolete and poorly productive old equipment, substitution which might not have been made without knowledge of replacement depreciation cost. Also, there has come into being an awareness on the part of management that values of fixed assets can be as volatile as those of inventory or labor, a fact which is overlooked many times, and can cause financial embarrassment and failure because of poor planning.

How to Get "Reproduction Cost New, Less Depreciation"

by ARTHUR L. BENJAMIN

Director of Insurance, The Cincinnati Gas & Electric Co.

Here narrated is a clearcut procedure, preceded by relevant general discussion, for finding and keeping up to date that value in buildings and equipment which insurance policies call "reproduction cost new, less observed depreciation." The paper is written with awareness of the long rise of price levels since the 1930's.

JUST WHAT IS INSURABLE VALUE? By definition, insurable value is the actual cash value at the time of a loss. You may well ask what that means. As a matter of pure mathematics, the actual cash value at any time is the present worth of the future benefits which the owner expects to derive from his use of the property in question. However, by common consent and court decision this present worth or actual cash value has been defined for insurance purposes as the reproduction cost new, less observed depreciation, however caused. This, then, is the value which the insurance manager must, in some way, develop. Because there are the two basic factors named, it would seem logical to discuss them each.

How Can We Get "Reproduction Cost New"

The first of these factors in reproduction cost. There are four principal sources of reproduction costs. These are:

1. Original construction costs.
2. Appraisals by independent appraisers.
3. Self appraisals by the insurance department.
4. Tax values.

Of these four sources of, or starting points for, determining reproduction cost, original construction costs are, quite understandably, the most accurate, since, if the proper cost indices are used to bring original costs to present day costs, there is practically no margin for error. If the insurance manager has original construction costs available, he should, by all means, use them to develop insurable value.

Nevertheless, reconstruction costs developed by independent appraisers are quite likely to be very satisfactory, particularly if the appraiser is clearly competent. The independent appraiser has the advantage of being able to compare his answer with the answers obtained in other appraisals and thus, so far as this helps, will be protected from inaccurate results. Still, in many cases, the cost of an appraisal is more than is warranted by the size of the risk or the premiums involved.

Self appraisals by the insurance department can be quite accurate, provided the person making them is reasonably careful both as to his selection of unit construction costs and his use of the proper conversion factors. Also,

in some special cases, tax values are a reasonably accurate source of reproduction costs, but their use is not recommended since they must always be processed by someone familiar with the relationship between tax value and real value.

Alternatives in Determining Observable Depreciation

The second element of an insurable value is depreciation. Here too, there are four sources of information, i.e., the four principal methods of depreciation. They are:

1. Straight line method.
2. Fixed percentage of depreciated value method.
3. Sinking fund method.
4. Present worth method.

Of these four, the straight-line method is the most widely used. The straight-line depreciation assumption is that the loss of value due to depreciation of any physical property unit is distributed uniformly throughout its service life. In estimating depreciation, the straight-line assumption is applied to the probable life of the particular unit in question and the resulting percentage of depreciation is then applied uniformly each year. The fallacy in this method is that the life expectancy is based either upon an estimate for the particular asset or the average life expectancy of a number of similar units of property. Since even similar units of the same kind do not have an equal service life, the depreciation taken under this method is nearly always too large or too small. Nevertheless, the straight line assumption lends itself quite well to simple calculations and is, therefore, more widely used than any other method.

The fixed percentage of depreciated value method of depreciation is a variation of the straight-line method, applying the percentage to the depreciated value rather than to the value new. This method is rarely used in the United States, since it does not represent a fair picture of the present worth of the property but more closely indicates the second hand value. It should be noted, nevertheless, that extension of its use could result from proposed provisions of the Revenue Act of 1954 now under consideration in the Congress. This method has been used to some extent in England but is being gradually discarded in favor of other methods.

The sinking fund method of depreciation is more widely used than any other method except the straight-line. The sinking fund depreciation assumption is that the total accrued depreciation of any property unit at any date is equal to the corresponding accumulation of money in a fictitious equal annual year-end payment depreciation fund in which the total accumulation at the end of the service life would be just sufficient to repay the units value new, less salvage. The sinking fund method is subject to the same inaccuracies as the straight-line method.

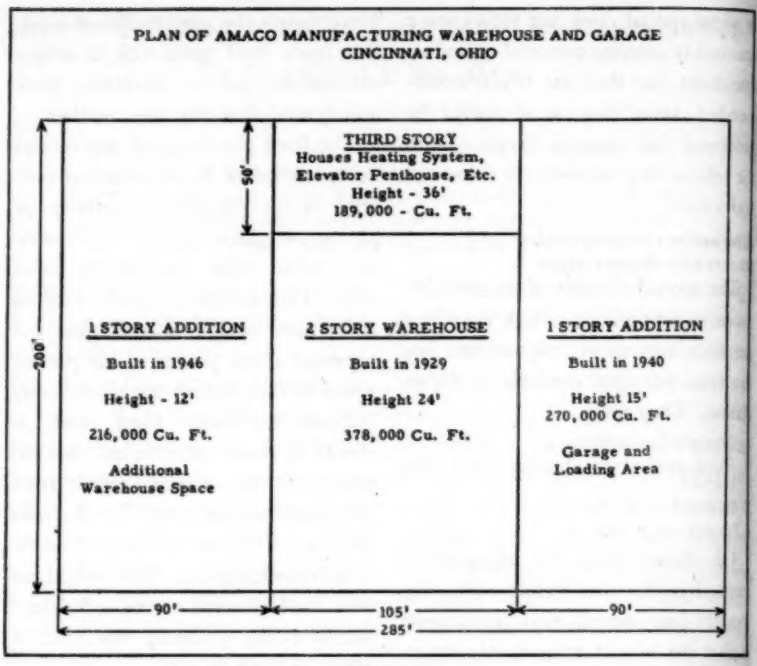

EXHIBIT 1

The present worth depreciation principle is probably the most accurate of any method, since it is based upon the theory that the depreciated value of an industrial property unit at any date of its service life is the present worth at that date of the probable future services. This method, however, requires the use of a rather complicated formula, and, for this reason, is not too popular with appraisers.

Developing Insurable Value at Date of Purchase

Thus far, we have concerned ourselves with some of the underlying considerations which confront every appraiser, whether he is the professional who does appraisal work as a business or an insurance manager who must make appraisals as a part of his insurance administration duties. It is not my intention here to go into any great detail in explaining these basic principles but rather to use some of them to show how to develop accurate insurable values.

The problem is to develop an accurate yet relatively simple method of calculating insurable values. For the purpose of this presentation I am go-

DATA FOR DEVELOPING INSURABLE VALUE

Building purchased in 1939
Building built in 1928
Age at time of purchase—11 years
Building specifications:

***Foundations*—Reinforced concrete**

***Walls*—12 inch brick**

***Interior Construction*—Structural steel frame, steel columns, beams, and girders, steel work protected by 2" of concrete, live load 200 lbs., per square foot.**

***Floor*—Monolithic cement floor finish**

***Partitions*—Concrete block or metal**

***Roof*—Built-up composition on concrete slab**

***Service Improvements*—Steam heat, electric lighting and wiring in Conduit, stairways with proper cut offs, fire doors where required, modern plumbing, raised loading dock, electrically operated overhead doors, 5000 pound freight elevator in brick shaft.**

***Size*—Main building—105' X 200'—2 stories**
Loading area and garage—90' X 200'—1 story
Penthouse (3rd Floor)—50' X 105'

EXHIBIT 2

ing to assume that I am the insurance manager of the Amaco Manufacturing Company and that we have just bought a warehouse and garage building. It is my job to purchase insurance coverage for this building at the time it is bought and to keep the record of its insurable value up to date as time passes. As insurance manager I arrive at the following decisions:

1. To make the original appraisal myself.
2. To use the straight-line depreciation method.
3. To avail myself of cost indices and unit costs as published by E. H. Boeckh & Associates, in developing my original appraisal.

In this connection, I use the Boeckh system because it is one with which I am most familiar and which has an accurate relationship to the types of properties owned by the Amaco Manufacturing Company. There are a number of other appraisal systems which are as good. Each company will select the one best-suited for its needs. If properly used, any good appraisal system will produce satisfactory results.

My first job is to make an inspection of the newly-acquired property to develop certain basic data. Exhibit 1 is a plan of the building as it now stands and contains dimensions and dates needed for appraisal and subsequent review. (When Amaco acquired it, only the center section was built. The two wings were added later.) Exhibit 2 is a statistical sheet developed from

STEPS IN DEVELOPING INSURABLE VALUE

STEP	SOURCE
Appraisal as of 1939	From statistical sheet
Building built in 1928	" " "
Ground area—21,000 sq. ft.	From ground plan of building
Wall perimeter—610 ft.	" " "
Cubic content—567,000 cu. ft.	" " "
Base price per cubic foot—$.327	From Boeckh's "Manual of Appraisals"—Index 100
Base cost—567,000 x .327 = $185,410 at Index 100	
Since this is based upon Index 100, it is necessary to convert it to 1939 actual cost.	
Conversion factor—118.8	From Boeckh's "Index of Construction Costs."
Reconstruction cost in 1939—$185,410 X 1.188 = $220,260	
Uninsurable deductions—12%	From Boeckh's "Manual of Appraisals"
Net reconstruction cost—$193,830	
Depreciation—11 years at 1½%—16½%—$31,980	
Insurable value as of December 31, 1939—$161,850	

EXHIBIT 3

my visit and contains most of the preliminary data necessary for our appraisal.

With the data from these exhibits, it is now possible to make our appraisal and to develop an insurable value for the building. It will be noted that the building was put up in 1928 and the appraisal date is in 1939. (Nevertheless, we continue our narrative in the present tense, as the procedure is still applicable.) The age of the building at the time of purchase, therefore, is eleven years. The ground area of the building is 21,000 square feet and its wall perimeter 610 feet. It contains 567,000 cubic feet. Using this information and the specifications and turning to the appraisal manual, it is found that such a building can be built for $.327 per cubic foot at Index 100.

At this point, it might be well to explain what is meant by Index 100. The appraisal system we are using converts all unit costs for various types and sizes of buildings to the cost of that type of building in the years from 1926 through 1929. The index for these years is, therefore, unity or 100. All indices of construction costs, before or after those years, are either larger or smaller than 100, depending upon the trend of construction costs.

The cubage of the building is now multiplied by the unit cost at Index 100 to obtain the following:

DATA ON POST-PURCHASE ALTERATIONS NEEDED TO KEEP INSURABLE VALUE UP-TO-DATE

1940—One story wing added as a garage section. This wing was added on side of building on which loading dock was located, and served to provide protected loading and unloading facilities in addition to truck storage. This section sprinklered at time of construction.

Cost of addition—$65,630.

Net reconstruction cost of addition—$59,060 (as of 1940).

1946—Another one story wing added on other side of building to provide more warehouse space. Wall between main building and new wing removed to provide open first floor. This section of building sprinklered at time of erection.

Cost of addition—$81,310.

Net reconstruction cost of addition—$73,180 (as of 1946).

Value of wall removed—$4,100 (out of 1939 appraisal).

1948—Balance of building sprinklered.

Cost of sprinkler system—$9,200.

Net reconstruction cost of sprinkler system—$9,200 (as of 1948).

(Insurable value to be determined as of December 31, 1952).

EXHIBIT 4

567,000 X $.327 = $185,410 at Index 100.

Since the appraisal, however, is for the year 1939, it is necessary to convert the above unity cost to the proper year. From the index of construction costs, a conversion factor of 118.8 is found for the year 1939. Converted reconstruction cost as of 1939 will then be:

$185,410 X 1.188 = $220,260 in 1939.

This reconstruction cost for 1939 is over-all. It contains cost for certain uninsurable items, such as foundations, footings, underground piping and excavations. These costs must be deducted from reconstruction cost, in order to obtain a net figure for insurance purposes. Using the appraisal manual again, we find that, for the type of building under discussion, uninsurable items amount to twelve per cent of total reconstruction cost. Reconstruction cost must, therefore, be adjusted, as follows:

$220,260 X .88 = $193,830.

This is our net reconstruction cost as of 1939.

We have, however, one other factor to take into consideration. This factor is depreciation. Since our building was built in 1928, and our appraisal is for 1939, we must deduct eleven years of depreciation. Again referring to our appraisal manual, we find that buildings such as that under

RECORD BY YEARS OF PHYSICAL CHANGES AND RELATED COSTS

Amaco Mfg. Co.

Warehouse & Garage Bldg. — W. O. for Year Appraisal - 1939

ADDITIONS

W. O. NO.	DATE C. O.	DESCRIPTIONS	BUILDING	CONTENTS	OUTDOOR EQUIP.
Net cost of reproduction new as of Dec. 31, 1939			193,830		
Retirements out of appraisal Year	1946		4,100		
Net portion of 1939 reproduction cost remaining			189,730		

Amaco Mfg. Co.

Warehouse & Garage Bldg. — W. O. for Year 1940

ADDITIONS

W. O. NO.	DATE C. O.	DESCRIPTION	BUILDING	CONTENTS	OUTDOOR EQUIP.
40 - 1		Erect one story wing on loading dock side	59,060		

EXHIBIT 5

discussion have a life expectancy of sixty five years with normal maintenance. Our rate of depreciation on this basis will be 1½% per year, or a total, of 16½% for eleven years. We, therefore, adjust our net reconstruction cost as follows:

$193,830 X .835 = $161,850.

This is the insurable value of our building as of December 31, 1939. The various steps in the calculation are recapitulated in Exhibit 3. It will be noted that all figures end evenly. This is because all costs are rounded off to the nearest ten dollars in order to simplify calculations.

Revising Insurable Value for Cost-Level and Physical Changes

The next problem is to keep this insurable value up to date. Because, in the instance used here, the time has been set at 1939, it is possible to illustrate the subsequent problem by carrying on to the present. If no changes are made in the building, this is quite simple, since we have only to use net reconstruction cost as of 1939, multiply it by a factor which represents the ratio of the index of construction costs in the year in question to the index of construction costs in 1939, and then deduct depreciation at the rate of 1½ per cent per year

SUMMARY COMPUTATION OF INSURABLE VALUE

Amaco Mfg. Co.

Warehouse & Garage Bldg. — Insurable Value as of 12/31/52

	PERCENT OR FACTOR BLDG.	CONTS.	BUILDING	CONTENTS	OUTDOOR
1939 Appraisal			189,730		
1940 Additions			59,060		
1946 Additions			73,180		
1948 Additions			9,200		
Adjusted to 1952 costs					
1939 Appraisal	2.13		404,120		
1940 Additions	2.11		124,620		
1946 Additions	1.54		112,700		
1948 Additions	1.17		10,760		
Total at 1952 Prices			652,200		
Depreciation to 12/31/52					
1939 Appraisal - Age 24 yrs.	36%		145,480		
1940 Addition - Age 12 yrs	18%		22,430		
1946 Additions - Age 6 yrs	9%		10,140		
1948 Additions - Age 4 yrs	6%		650		
Total Depreciation			178,700		
Insurable Value - 12/31/52			473,500		

Note: Maximum depreciation - 40%

Non-insurable vlues have been excluded

EXHIBIT 6

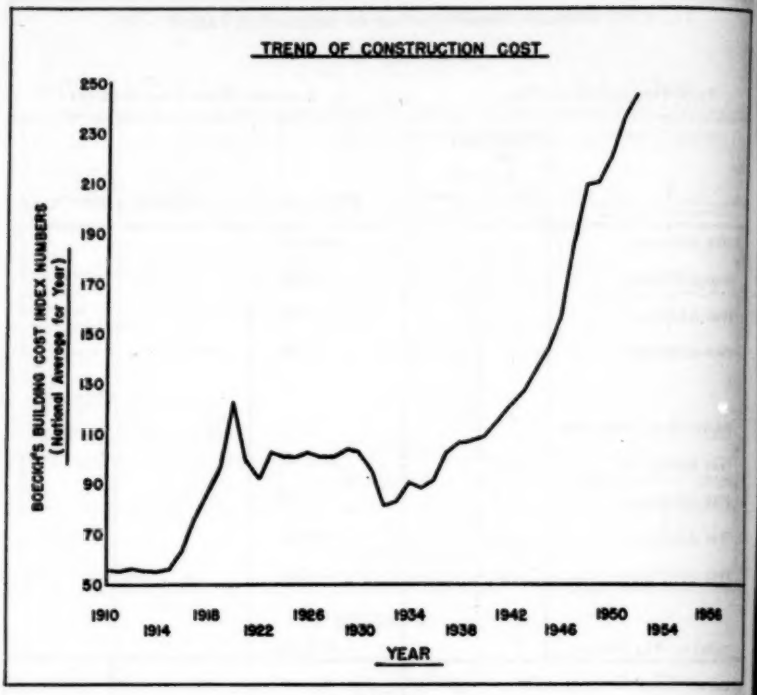

EXHIBIT 7

since 1928, but not to more than 60 per cent net value as long as it is used and useful.

However, it is quite rare for a building to remain as is. In general, numerous alterations take place from time to time. We will assume that such is the case for Amaco's warehouse and garage building. Exhibit 4 traces the history of the building from 1939 to 1952.

These changes are shown in one exhibit, for purposes of this paper. In practice, as they occurred over a period of years, the net reproduction costs would be transferred each time to the insurable value file for the warehouse and garage building. The form on which this information is kept is shown in Exhibit 5. This discloses the acquisition value in 1939 and the record of a 1940 addition. The net reconstruction costs, which are the actual costs less uninsurable item costs, are used. In the case of the wall removal between the 1946 wing and the main building, its value is deducted from the 1939 appraisal, and the net por-

tion remaining is shown at the bottom of the form. A sheet like those for 1939 and 1940 is made up for each physical change.

We are now in a position to calculate the insurable value for 1952. The manner in which this is done is shown on Exhibit 6. It will be noted that the net reproduction costs of the various building alterations have been transferred to the summary sheet. Each of the individual year costs is now adjusted to 1952 prices, by multiplying the respective figures by the ratio of the 1952 index of construction costs to the index of construction costs of the respective years. From these calculations, the net reconstruction cost of the warehouse and garage as of December 31, 1952 amounts to $652,200. (This is not total reconstruction costs since noninsurable items have been deducted on the individual detail sheets.)

The next move is to apply the proper depreciation to the net reproduction costs for the various years in question. The manner in which this is done is shown on the bottom of the summary sheet. The total depreciation amounts to $178,700. This amount is deducted from the previous total and we obtain:

Insurable value as of December 31, 1952 = $473,500.

Necessity for Review of Values Periodically

At this point it is necessary to refer to a final exhibit. Exhibit 7 shows the national average trend of construction costs for all types of construction. It is notable that costs have more than doubled since 1939. It is for this reason that it is important that the insurance manager review his insurable values from time to time. If he fails to do so, he may well find himself the loser in the application of the co-insurance clause in a loss. In my company, we examine insurable values on our larger properties every six months and on all properties each year.

Recapitulation

To summarize, it may be advantageous to repeat some of the more important points stressed in this article:

1. Whenever possible, use actual construction costs to obtain insurable values.
2. If actual costs are not available, the property in question should be appraised as outlined in this discussion, using an appraisal system most applicable to the properties to be insured.
3. Use care in the selection and application of the cost indices used to convert construction costs to present-day reconstruction costs.
4. Select a depreciation method which will give accurate and acceptable results without involving complicated formulae.

At first glance, the system outlined in this discussion may seem to be somewhat complicated but, in reality, it is quite simple. One does not have to be an experienced appraisal engineer to use it and, with a little practice and study, anyone can apply it to the properties under his supervision.

Tax Effects of Declining Balance Depreciation

by W. H. BEADLE

Controller, New Holland Machine Division of the Sperry Corp., New Holland, Pa.

Pointing out both that the tax advantage of larger annual provisions for depreciation available under the declining balance method, is restricted to early years of asset service lives and that these years may well be critical ones in the cycle of investment, the author of this article discusses the current proposal to permit depreciation deductions for tax purposes to be computed by this method on a liberalized basis. Comparisons with the straight-line method are offered.

PROPOSED CHANGES in the Federal income tax law contained in the President's budget message and the publicity releases of the House Ways and Means Committee were received with enthusiasm by taxpayers and investors alike, especially the recommendation that the declining-balance method of depreciation be permitted at double the straight-line rate.

The purpose of this discussion is to (1) illustrate the obvious difference between the two methods of depreciation, (2) examine the apparent advantages favoring use of the declining-balance method to see whether these advantages are not, after further study, altogether illusive, and (3) explore some problems which might need looking into by a taxpayer thinking of adopting this method of depreciation.

Short and Long-Term Comparisons of the Two Methods

A simple illustration of the year-to-year and the cumulative differences in depreciation under the two methods, when applied to an asset having a ten-year normal life, appears in Exhibit 1. There are a number of significant facts which the illustration makes clear. The first is that, during each of the initial four tax years, depreciation is greater under the declining-balance method, the cumulative advantage at the end of the fourth year being equal to 18 per cent of the original cost of the asset. However, each year thereafter, depreciation is less under the declining-balance method, until the cumulative advantage of the first four years is finally lost during the ninth tax year. From that point on, both the year-to-year and the cumulative depreciation are less under the declining-balance method until the "normal" retirement date is reached. Under the declining-balance method, depreciation continues past this date until the asset is actually retired.

The implication of Exhibit 1 for assets over a wide range of normal lives is emphasized by Exhibit 2. In this table, the half-year convention and declining balance rates at double

DEPRECIATION SCHEDULE

Comparing Declining-Balance Method to Straight-Line Method on a 10-Year Asset Under the Half-Year Convention

YEAR	YEARLY DEPRECIATION			CUMULATIVE DEPRECIATION		
	DECLINING BALANCE METHOD	STRAIGHT LINE METHOD	DIFFERENCE	DECLINING BALANCE METHOD	STRAIGHT LINE METHOD	DIFFERENCE
½	10.0%	5%	5.0%	10.0%	5%	5.0%
1½	18.0%	10%	8.0%	28.0%	15%	13.0%
2½	14.4%	10%	4.4%	42.4%	25%	17.4%
3½	11.5%	10%	1.5%	53.9%	35%	18.9%
4½	9.2%	10%	(.8%)	63.1%	45%	18.1%
5½	7.4%	10%	(2.6%)	70.5%	55%	15.5%
6½	5.9%	10%	(4.1%)	76.4%	65%	11.4%
7½	4.7%	10%	(5.3%)	81.1%	75%	6.1%
8½	3.8%	10%	(6.2%)	84.9%	85%	(.1%)
9½	3.0%	10%	(7.0%)	87.9%	95%	(7.1%)
10½	2.4%	5%	(2.6%)	90.3%	100%	(9.7%)
11½	1.8%	–	1.8%	92.1%	100%	(7.9%)
12½	1.4%	–	1.4%	93.5%	100%	(6.5%)
13½	1.1%	–	1.1%	94.6%	100%	(5.4%)
14½	.9%	–	.9%	95.5%	100%	(4.5%)

Depreciation is expressed as a per centum of first cost.

EXHIBIT 1

the straight-line rates are used.

Certain conclusions may be drawn from Exhibit 2. It may safely be said that a real advantage exists under the declining-balance method for better than a third of the normal life of an asset. This advantage tends to decrease as the normal life increases. Then, the advantage gained in the early years is gradually dissipated and is entirely exhausted much before the normal retirement date. Further, the net book value at the end of the normal life tends to increase with the latter. Briefly, from a financial viewpoint, it appears that capital recovery takes place faster in the early years under the declining-balance method of depreciation. This observation needs further analysis by each taxpayer in the light of his own particular circumstances.

It is conceivable that extended use of this method of depreciation for tax purposes would lead to its recognition by the Government for the purpose of determining costs allocable to Government contracts and by regulatory bodies as a permissable accounting method for establishing rates for utility services, freight and fares, where more favorable methods do not already exist. If so, increased revenue could result from

Pertinent Differences Which Would Result From Use of the Declining-Balance Method of Depreciation at Double the Straight-Line Rates (Half-Year Convention Used)

	"NORMAL" LIFE OF ASSET (YEARS)			
	5	10	20	40
1. Initial period in which depreciation is greater under declining-balance method	2 yrs.	4 yrs.	7 yrs.	15 yrs.
2. Apparent cumulative advantage at this point, expressed as a percentage of original capital cost	22%	18.9%	17%	16.25%
3. Tax year in which apparent cumulative advantage is entirely exhausted	4th	9th	18th	34th
4. Declining-balance not yet depreciated at end of "normal" life (expressed as a per centum of first cost)	6.3%	9.7%	11.2%	13.0%

EXHIBIT 2

its adoption which, when coupled with the tax benefits, would accelerate recovery of the investment. However, the average manufacturer gives more consideration to the competitive situation than he does to his costs when he establishes his selling prices. Any increase in the rate of depreciation, in such cases, would be entirely offset by a reduction in profits before taxes. Thus, the capital recovery, despite the conventional financial concept to the contrary, would be limited to the taxes saved by the increase in the rate of depreciation in the early years of an asset's life.

Tax Rates Pose The Problem

Although this early tax advantage would exhaust itself in later years, the taxpayer's cash problems would have been considerably alleviated, meanwhile, if tax rates were the same in all years. The real problem in deciding whether to adopt the declining balance method lies in the absolute unpredictability of income tax rates. A tabulation (Exhibit 3) of maximum composite rates of Federal income and excess profits taxes since 1930 is ample evidence of this fact. This tabulation is worthy of careful scrutiny. It seems improbable that corporation tax rates will ever be reduced to the levels prevailing in the 1930's. However, assuming that future rates might range from 38 per cent to 85 per cent in the years ahead, it is possible that the timing of future rate changes could prove disadvantageous to a taxpayer who had elected to use the declining-balance method of depreciation.

As an example of possible effects on net profit after taxes, assume that a taxpayer purchases twenty-year assets in 1954 and had the tax experience illustrated in Exhibit 4. (The reader should understand that this is not an expression of pessimism in attitude, but, instead, an assumption that history

MAXIMUM COMPOSITE RATE OF FEDERAL TAXES ON LAST DOLLAR OF INCOME
(Corporations)

YEAR		MAXIMUM POSSIBLE COMPOSITE RATE
From	To	
1930		12%
1931	1935	13¾%
1936	1937	15%
1938	1939	19%
1940		62%
1941		76.4%
1942	1943	81%*
1944	1945	85½%*
1946	1949	38%
1950		57%
1951		80¾%
1952	1953	82%
1954		(Probably 52%)

* After deduction of 10% post-war refund credit.

EXHIBIT 3

will continue its habit of repeating itself.) The set of hypothetical circumstances set forth illustrates that it may be possible for a taxpayer to earn less after taxes, as a result of adopting the declining-balance method.

Offsetting this, of course, are the financial advantages of conservatism in accounting. One of these is faster capital recovery in the early years through tax savings. This would improve the net working capital position in those years. Interest savings would result from two possible events: (1) tax savings in the early years could be used to pay off interest bearing loans and (2) the lower profits reported under the declining-balance method might keep dividend payments at a lower level, thus further conserving cash and decreasing interest costs. (The latter might not be considered by stockholders to be an advantage.) It could also happen that the capital recovered in the early years would be reinvested in additional capital equipment. This should increase the earning capacity of the taxpayer by, in a sense, financing expansion through tax savings.

A Useful Partial Stimulus to Capital Outlay

In summary, it is the writer's belief that the financial advantages of the declining-balance method of depreciation at double the straight-line rate favor its adoption. The long-term growth of our economy will require continued capital expenditures. Although these may be cyclical in behavior, it is likely that the peaks in expenditures will coincide to a large extent with high tax rates. Although this favors adoption of the declining-

An Illustration of Possible Tax Differences Under Declining-Balance Method of Depreciation — 20-Year Assets Half-Year Convention

	YEARLY DEPRECIATION					
YEAR	DECLINING BALANCE METHOD*	STRAIGHT LINE METHOD*	DIFFERENCE*	TAX RATE**	TAX SAVING OR (LOSS)*	CUMULATIVE TAX SAVING OR (LOSS)*
1954	5.0	2.5	2.5	52%	1.300	1.300
1955	9.5	5	4.5	47%	2.115	3.415
1956	8.6	5	3.6	42%	1.512	4.927
1957	7.7	5	2.7	40%	1.080	6.007
1958	6.9	5	1.9	38%	.722	6.729
1959	6.2	5	1.2	38%	.456	7.185
1960	5.6	5	.6	40%	.240	7.425
1961	5.0	5	—	40%	—	7.425
1962	4.5	5	(.5)	45%	(.255)	7.200
1963	4.1	5	(.9)	45%	(.405)	6.795
1964	3.7	5	(1.3)	65%	(.845)	5.950
1965	3.3	5	(1.7)	80%	(1.360)	4.590
1966	3.0	5	(2.0)	85%	(1.700)	2.890
1967	2.7	5	(2.3)	85%	(1.955)	.935
1968	2.4	5	(2.6)	85%	(2.210)	(1.275)
1969	2.2	5	(2.8)	85%	(2.380)	(3.655)
1970	2.0	5	(3.0)	45%	(1.350)	(5.005)
1971	1.8	5	(3.2)	45%	(1.440)	(6.445)
1972	1.6	5	(3.4)	45%	(1.530)	(7.985)
1973	1.4	5	(3.6)	45%	(1.620)	(9.605)
1974	1.3	2.5	(1.2)	45%	(.540)	(10.145)
1975	1.2	—	1.2	40%	.480	(9.665)
1976	1.1	—	1.1	40%	.440	(9.225)
1977	1.0	—	1.0	40%	.400	(8.825)
1978	.9	—	.9	40%	.360	(8.465)
1979	.8	—	.8	40%	.320	(8.145)
1980	6.2***	—	6.2	45%	2.790	(5.355)
				Total	5.355%	

* Expressed as a percentum of first cost.
** Hypothetical tax rates used.
*** Asset retired and balance written off.

EXHIBIT 4

balance method, it also emphasizes the importance of timing, both in the making of expenditures and the adoption of the depreciation method.

In view of this, it is important to provide some other stimulus to the economy, if the President's immediate objectives are to be attained. It would seem that this could be accomplished by a substantial liberalization of the allowable depreciation rates under both methods. This would accelerate the advantages to be gained by adoption of the declining-balance method and should prove to be a real stimulant to large segments of the economy.

A Free-Curve Depreciation Method

by Glen W. Lewis

Financial Analyst, Ford Motor Company, Detroit, Mich.

Another candidate, to "stand for selection" along with more prominent and other available depreciation calculation methods, is here presented, with a bow to difficulty in its mathematical derivation. It is recommended as accelerating annual depreciation provisions and also completing them, thus remedying respective weak points in straight-line and declining balance methods.

AMONG DEPRECIATION METHODS, two examples of geometrically progressive curves (a series of numbers, each of which bears a fixed ratio to the next one) are straight-line (where each charge is 100 per cent of the next one) and declining balance. A third example of geometric progression may be described as a free curve, since it is not bound by the limitations of the first two examples. The free curve can provide successively decreasing charges (as in declining balance), and at the same time write off one hundred per cent of cost (as in straight line). The merits of such a curve for practical use in computing depreciation are partially offset by the necessity of using factors derived from formulas which are rather complex.

The Free Curve Formula

The mathematical basis of the free curve may be interesting to algebra students, but it is not necessary reading for an accountant or business executive. Either can, if he wishes, confine himself to the application of the formula. Where the asset lives are ten years or more, the recommended free curve formula is:

$$(9A - 7R) \div 5AN = \text{Annual depreciation rate}$$

Where:

A = Asset account at beginning of year.
R = Reserve account at beginning of year.
N = Average asset life.

Even if the mathematics supporting this formula are not easily understood, the formula itself is simple to use. By using it, the proper weighted average rate for the current year for any property account can be computed in a few minutes. This rate can then be divided by twelve and the resulting monthly rate applied to departmental asset balances each month in the normal straight-line manner. For an asset life of ten years or more, this formula will write off approximately two-thirds of cost in the first half of the asset life and approximately one hundred per cent during the total life. The formula provides ease of application (the rates are applied as though they were straight line rates), (2) reasonable acceleration, and (3) complete write-off during the asset life. No other depreciation method has all three of these attributes.

Comparison Among Available Depreciation Methods

For comparative purposes, six depreciation curves are shown in the following schedule:

	Geometric progressions			Other		
Year	Straight line	Declining balance	Free curve	Sum of years' digits	Multiple straight line	Sine curve
1	10.0	20.0	18.0	18.2	12.5	15.6
2	10.0	16.0	15.5	16.4	12.5	15.3
3	10.0	12.8	13.3	14.5	12.5	14.5
4	10.0	10.2	11.4	12.7	12.5	13.4
5	10.0	8.2	9.9	10.9	12.5	11.9
6	10.0	6.6	8.4	9.1	12.5	10.2
7	10.0	5.2	7.3	7.3	12.5	8.2
8	10.0	4.2	6.3	5.5	12.5	6.0
9	10.0	3.4	5.4	3.6	0	3.7
10	10.0	2.7	4.6	1.8	0	1.2
Accumulation:						
Halfway value	50.0	67.2	68.1	72.7	62.5	70.7
Ending value	100.0	89.3	100.1	100.1	100.1	100.1

(The foregoing amounts have been rounded off to one decimal place for illustrative purposes.)

An ideal depreciation curve will have a value halfway through the asset life somewhat higher than 50 per cent and a value at the end of the asset life of approximately 100 per cent. The straight line does not meet these requirements because at the half-way mark, the result is too low. The declining balance fails to meet the requirements because, at the end of service life, depreciation is not complete. The other curves are satisfactory in these respects. However, the three curves which are not geometric progressions cannot be used on the basis of the information normally available. The property account must be analyzed into age groups according to the year of acquistion of each item, in order to use these latter three methods. The normal manner in which equipment is recorded, by plant and department, is not sufficient. A break-down by ages is also required. This practical difficulty has the effect of offsetting the theoretical advantages of these curves.

The effect of each of six curves is shown below in the computation of depreciation on an equipment account containing items of various ages. The balance of the account is $1,000 and the reserve previously accumulated is $400. The results of the six methods are as follows:

Method	Computation	Depreciation charge
Geometric progressions:		
Straight line	Asset multiplied by 10%.	$100.00
Declining balance	Reserve subtracted from asset and remainder multiplied by 20%.	120.00
Free curve	Asset multiplied by 18% less reserve multiplied by 14% This is the (9A—7R) ÷ 5 AN formula as applied with a ten year life.	124.00
Other methods:		
Sum of year's digits	Each age group	129.34
Multiple straight line	multiplied by its appropriate rate*	110.00
Sine curve		122.72

* Based on an assumed age analysis (beginning of year)

Summary

One advantage of an accelerated curve is that, to a limited extent, it tends to correct errors caused by using improper asset lives in the computations. For example, suppose the estimated average life is only one half of the actual average life. The straight-line method will produce charges which are twice the proper amount and they will continue to be at that level. However, the declining balance or free curve methods will only produce one charge which is twice the proper amount. After the first charge, the excess will become progressively less because the excessive reserve automatically effects a reduction in subsequent charges.

All depreciation methods are based upon curves which are either geometric progressions or nongeometric progressions. The latter group has little to recommend it because of the detailed records by age groups which it requires. Geometric progressions include the straight line, declining balance, and free curve. The advantage of the straight line is in its understandability. Its disadvantage is in its lack of acceleration. The advantage of declining balance is in its acceleration and in its partial correction of errors. On the other hand, it does not fully depreciate the assets. The free curve provides reasonable acceleration and a complete write-off of cost during the asset life and it shares with the declining balance method the automatic tendency to correct errors.

Depreciation Is a Period Cost — Practically Speaking

by O. E. HANSON

Chief Plant Accountant, Marathon Corporation, Menasha, Wisc.

Conceding that a portion of the depreciation charge is a variable product cost, the present author, nevertheless, considers its entirety to be a fixed period cost and offers the reasoning supporting this as also comprising a valid case for direct costing.

IT IS THE GOAL OF THIS PAPER to bring out some background considerations with respect to depreciation as a cost and to arrive at some conclusions to stimulate further evaluation. The reader must not be surprised if, before we are through, we have ammunition with which to enter the direct vs. absorption costing controversy.

A Look At The Conventional Absorption Procedure

Under conventional accounting or absorption costing procedures, depreciation is treated as an overhead item, placed usually at the end of the detail of any expense classification and relegated to the bottom of a cost center statement or deparmental cost analysis. It is charged, usually, directly to the applicable cost center and, in the case of service centers, is distributed back to producing centers in the lump spread for determination of a producing cost center charging rate. Or it may be included in a burden charge directly against a product through correlation to a predetermined base such as direct labor hours, labor dollars, or like bases, as is typically done under variations of job costing techniques.

There may be numerous practices for disposition of this expense but all methods, under absorption costing, converge to one result. Depreciation expense winds up as an overhead, burden, or indirect cost item in product costs. In other words, an estimated absorption rate is set up for this known expense item (known to the extent we have charged so much off to this period), so that all production includes a portion of its cost. Hence, each in-process and finished goods inventory contains, under conventional costing, a segment of the period's depreciation charge. The degree of accuracy enjoyed in absorbing the period's depreciation through the estimated burden rate is determined by the actual level of production for the period. Putting it another way, it may be said that transfer of production to inventory has under- or over-absorbed the depreciation charge in direct ratio to the per cent of accuracy represented by the budgeted production level. In short, a cost of known and definite amount is charged to costs by way of a prophecy of the quantity to be made. The extent of error is called under- or over-

absorbed overhead, or volume variance.

But does not this very practice admit that depreciation is a period cost? On our assest ledger it is. Why try to include an estimated pro-rata amount in our product costs to inventory? In considering this, let us take a look at some of the costs called fixed under conventional accounting treatment. The classification of expenses into fixed, semi-variable, and variable generally refers to the reaction of the respective items to changes in volume or output. Among the expenses normally considered fixed are property insurance, taxes on real and personal property, building and equipment rentals of definite periodic amount, depreciation, certain salaries, etc. These expenses are considered as normally constant whatever the volume of output, depending upon a definite period of time for orderly amortization and expiration to a predetermined date.

Depreciation as a "Mixed Cost"

In this view of fixed costs how does depreciation stack up? Can we justifiably treat it as a cost to be absorbed by the specific type and quantity of products we make, or is it more realistic to view it as "the periodic charge-off of an equitable portion of the cost of assets which have a limited service life," which life is more or less irrelevant to the foreseeable productive capacity at the time of acquisition? Perhaps neither classification entirely fits it. Depreciation may reasonably be called a hybrid cost, in part period cost and part product cost. The two principal and most common factors causing depreciation are (1) wear and tear, and (2) inadequacy and obsolescence. The former is a product cost and the latter a period cost.

Both causes are observed to operate in most companies. As to obsolescence, relatively unworn machines are replaced by more advanced models. On the other hand other facilities of still good design must be traded in because they are physically approaching the status of the one horse shay, i.e., threatening to fall apart at any moment. Thus, it would seem that proper and meticulous accounting for depreciation would dictate a dual treatment, that of separating the wear and tear portion to be written off from write-off due to obsolescence, inadequacy, or time-loss. The latter portion would be the true fixed, or period cost, to be spread out over the anticipated years of life until complete obsolescence. Wear and tear cost would be prorated on a production or output basis.

But now troubles arise. What portion of the cost of the asset pertains to obsolescence and what part to wear and tear? What length of time should be used for applying obsolescence? How much volume or production will wear the machine down to zero usefulness? Which element expires first, cost chargeable as obsolescence or that chargeable as wear and tear? Will not the expiration of either automati-

cally terminate the remaining utility of the other? What effect will plant and equipment maintenance program have on service life? As the questions multiply, it certainly becomes doubtful that an accountant is qualified, even with good engineering direction, to get involved in such intricacies with respect to the equipment in his organization.

Although we know there may be special circumstances in which depreciation must be considered strictly from an output standpoint, similar to depletion accounting, it would seem that fixed asset writeoffs, as we know them in the form of depreciation in the normal manufacturing concern, must be, from necessity, pegged to a time factor for their orderly disposition. The difficulty in attempting to separate the dollar amount of obsolescence from wear and tear, the inability to forecast output affecting wear and tear over a long period, and the overall fact that obsolescence and wear and tear are inter-related—all these factors lead to a conclusion that the conventional practice of considering and treating depreciation as a time or period expense, if questionable in isolated instances, is normally fair as a costing matter, from the accounting, financial, and management standpoint. Perhaps it is the lesser of several evils. Where it is grossly incorrect this is likely to be more the result of inaccurate service-life estimates or other factors, than the fault of the principle of charge-off on a time or period basis.

So the Decks Are Cleared for Direct Costing

If we thus agree that depreciation is essentially a fixed or period cost and, from this viewpoint, may be set alongside other costs mentioned above—and still other expense categories peculiar to individual businesses, we are clearing the deck for a broadside against absorption costing. If we now know a sizeable amount of our costs to be fixed, why do we attempt to absorb them on a projected activity basis, writing off any resulting misjudgments through under- or over-absorbed burden or volume variance and also deferring, through our fixed charges in inventory, a charge against next year's profits? A more accurate job or product cost procedure would seem to be to charge next year's profits with only the properly definable costs directly expended on the products in inventory. Such costs do not include costs for the period. This is the main point of direct costing.

This relatively new costing approach seems, after looking at it, to represent an easier and more effective way to do directly what we usually have to interpolate by analysis.

1. Accountants often spend hours discussing relatively small points relating to such items as proper service department distributions, cost center charges, etc., and are sometimes not as effective in showing management, via our conventional absorption costing techniques, the big picture as to where profit went or where it came from. Direct costing can offer assistance through the different presentation of such fixed costs as depreciation and can apprise management more effectively of the "sunk" cost of operating physical plant.

2. Certainly the profit-volume relationships of products and processes can be analyzed more effectively through the direct costing principle of separating period and product costs. The management tools involving the interplay of volume and costs, such as break-even charts and marginal costing, will be everyday aspects of industrial accounting.

3. In studying the fixed cost picture and thinking of the past and the future, it appears that we are continually swinging toward more fixed or period expense. The growth of pension programs, guaranteed annual wages, longer vacations, more paid holidays and sick leaves, an apparent deterioration in some of the skilled crafts tending toward making labor costs fixed, an increase in work simplification methods (which always seems to require more fixed equipment), increases in fixed cost specialists to "dream up" ideas for fewer variable cost workers — these all make it seem that truly variable costs are getting scarcer every year.

4. Technological developments — those we read about, hear about, or are in the middle of, seem to picture, eventually, a scattered few people running a vast industrial plant. To a degree, this has already happened in the newest and most modern refineries. Whether we will see a universal mechanization in our lifetimes or not is beside the main point here, that such a trend means more and more fixed or period cost (particularly depreciation) and less variable expense.

If these things are so, depreciation as a major element of cost will be increasingly important. In leaning toward the period cost principle for depreciation costing, partly because of the distinct problems inherent in attempting to account properly for the admitted wear and tear (product cost) aspect of depreciation, I submit that, if this thinking is agreed to, much weight is added to the increasing interest in and propriety of direct costing. Fixed costs, among which depreciation is usually a major factor, are and will be on the increase as a percentage of total cost and, as such, merit more attention in proper profit analysis, profit planning, and cost control. This would indicate, in one form or another, increasing adoption of the direct costing principle.

Depreciation's First Duty—Profit Measurement

by Eugene L. Zieha

Assistant Professor of Accounting, St. Louis University, St. Louis, Mo.

Briefly pointed up in this discussion are the several objectives for which depreciation may be used, with an indication that, whatever else is sacrificed, its service in measuring income should not be.

PROPOSED CHANGES in the income tax laws frequently suggest a more liberal policy regarding the timing of the charge for depreciation of fixed assets. Accountants are often called upon for an opinion regarding these proposals. The problem under consideration has many aspects and the possible effects of the suggested changes are not always readily evident. A review of some of the points involved may well be helpful. The primary objective of a tax is to raise funds for the operation of the Government. However, another objective, and one constantly referred to in current newspaper discussions of depreciation, is to influence the economic activity of the taxpayer. It must be noted that the objectives may not always be compatible. For example, a tariff which discourages the importation of a commodity, raises no revenue.

In the case at hand, recent statements of political leaders, as reported in the daily press, indicate that one objective of certain contemplated changes in the income tax law is to encourage business expansion. This would be done by allowing a greater part of the total cost of assets to be charged off in the early years of their life. Where the purpose of such proposals is to bring the law more in line with prudent business management, one cannot disagree. However, when changes in allowable depreciation charges are looked upon as a device to influence the business cycle, serious questions may arise, regarding both their equity and their practicality. It is therefore proper to inquire how these proposals for changes in the tax law fit with the accounting concept of depreciation.

The accountant uses the depreciation charge to spread the cost of a fixed asset over its useful life, in order to report the results of business operations as accurately as possible. While this allocation can be no more than an estimate, it yields satisfactory results when based upon the best judgment of the accountant and interested members of management. On the other hand, under the powerful influence of high tax rates, many people have come to look upon the depreciation charge as simply a deduction to appear on the tax return. They have comparatively little interest in making the most reasonable estimate of the economic life of assets. Instead, the idea is to deduct as much as possible on current tax returns, an attitude which is likely to cause some difficulties in future years when a large number of fully depreciated assets are still in use.

The basic problem is that the depreciation charge is being asked to serve too many purposes. The Government is now looking upon it as a device for modifying the business cycle. Taxpayers want to use it in a manner to obtain maximum short-range tax reductions. Yet, the depreciation charge must be used by the accountant in the measurement of profits. As these objectives are, at least at times, incompatible with one another, some are destined not to be achieved. It appears that truly objective

profit reporting is the most likely to be neglected.

There seems to be no immediate solution to the overall problem, but it does appear logical to expect that the same tool cannot be used successfully to accomplish diverse goals. A starting point for improvement of the situation would be to make it clear that depreciation is not a tool for control of the business cycle, whether the contrary idea emanates from Government or business. To consider it such a tool destroys its usefulness for accurate profit reporting and promises no true advantages. In fact, there is considerable danger that artificial business incentives of the character of stepped up depreciation may lead to economically unsound action on the part of those seeking the short-run advantages offered by the incentive.

The effects of high taxes are always bound to be detrimental to the exercise of best judgment in making estimates of the amount of depreciation to be charged. No practicable solution of this difficulty exists at the present time, but it does appear to be a situation which should be capable of correction. This is an area in which accountants must do considerable thinking if they are going to have depreciation figures suitable for accurate profit reporting and the formation of correct managerial decisions.

Inadequate Depreciation Charges Call for Action

by CLARENCE CROCHERON

Vice-President, American Appraisal Company, New York, N. Y.

For the author of the present article, the protracted debate in accounting circles (which tends to rise and wane with the appearance or disappearance of price level changes) on whether or not original cost is a satisfactory or, at least, appropriate basis for depreciation charges, is beside the point. Such charges, he contends, are promoting dissipation of capital. He regards it as a matter of moment that management counter-act their effects.

CONVENTION APPARENTLY dominates present ideas of depreciation, so far as so-called "general acceptance" goes. However, I have an idea that the dissenters are on the right track in the belief that the requirements of management are best served by realistic accounting. Numerous articles on the subject of relating depreciation charges to current replacement costs have been written. It is little short of amazing that so little has been *done* about it.

Convention Worse Confounded

Of course, if book costs really possess virtue in proportion to the respect which is paid them, perhaps there is good reason to protect their purity. Let's take a look at some of these costs as shown in the accounts. During a recent appraisal engagement I found a machine tool capitalized in the accounts in the amount of $5,000, based on the vendor's invoice, but with no allowance for cartage and installation costs. In another instance I found the record of a machine disposed of, credited to the property account. Further investigation revealed that the foundation on which it had reposed, had not been removed from the account. Nor is it unusual to find capital items on hand charged to expense and ordinary maintenance and repairs capitalized.

Confusion in property records was aggravated and the record of cost stultified by war and post-war conditions. During World War II emergency facilities were acquired under certificates of necessity and, by Treasury regulation, subsequently fully-amortized. Many companies dropped the total cost of emergency facilities out of both the asset and depreciation reserve accounts. Others did not disturb the asset cost and are continuing to carry the facilities in the accounts and in the reserve, without change, until disposed of. Still others restated the amounts based upon estimated useful values. After the war, plants in which large sums of money had been invested by the Government were acquired by industry from the War Assets Administration, at a fraction of

the original cost. This subnormal purchase price is the cost appearing on the fixed assets accounts under conventional practice.

Depreciation reserves are just as distorted as the property accounts, with corresponding distortions in the annual depreciation provision. Companies in the same industry are providing depreciation at rates which have no resemblance to one another. One of the reasons for this is that depreciation for corporate purposes follows pretty closely depreciation taken for tax purposes, and, accordingly, errors and excess depreciation taken in the past are reflected in the depreciation reserve accounts. A high depreciation reserve is the danger signal that attracts the attention of the Internal Revenue Service and frequently results in a reduction in the depreciation provision, based on the recovery of the undepreciated balance over the remaining useful life of the property. It can be imagined how inadequate this depreciation provision would be where the reserve amounts to, say 70 per cent of cost and where there is an estimated remaining useful life of fifteen years. The effective rate, in this instance, is only two per cent of original cost. This poses the problem as to whether we are realistic when we permit tax deductions to over-rule what might have been our better judgment in the determination of adequate provisions for financial and cost accounting purposes.

Those Are Not Earnings

Thus, again, it seems appropriate to comment that, despite a good deal of literature, nothing much is being done to correct a highly-doubtful situation. I am left with the feeling that the discussions have emphasized academic considerations rather than the real need for replacement reserves. In the light of this, I would like to express my own views and my reasons for advocating recognition of the effect of present price levels, on corporate accounting and cost accounting. As already stated, the discussion will be from the viewpoint of engineer and appraiser, and avoid discussion of accounting technique.

Where depreciation provisions are inadequate, earnings are erroneously overstated. It must be obvious that depreciation computed on original cost, without consideration for the fact that current costs of plant assets are more than double pre-war levels, is grossly understated and earnings correspondingly overstated. This could mean that dividends—actually unearned—may be distributed and, to this extent, impair capital. How can capital be obtained in adequate supply under these circumstances? Capital in industry is subjected to risks and competition. New capital is sought when expansion is contemplated. New capital can hardly be attracted when the

need for it is not expansion but rebuilding of a worn-out plant.

Also, if depreciation is provided on the basis of book cost—and that book cost is less than current replacement cost—it would seem that the company would also be shipping part of the plant to the customer free with each order. This would not be the case were the depreciation allowance related to replacement costs in fixing selling prices. In sum, if this is not done, the business cannot be expected to continue to reproduce itself for future production demands.

The matter of how the depreciation or the reserve for replacement is to be reflected in the accounts—I leave to the accountant. However, just because there may be some difference of opinion as to accounting techniques, this does not seem to warrant delay in taking positive action on the broader problem. Capital is definitely in jeopardy and products may be unknowingly under-priced. Management should be encouraged rather than discouraged from taking action. There is a further hindrance, given entirely too much influence. At the present time, the taxing authorities will not permit depreciation deductions on a basis of current replacement costs. That, however, is no reason for not making adequate provision for replacements at present price levels in considering selling prices and in portraying earnings realistically for the benefit of the management, stockholders, employees, labor leaders, the Government and others interested.

Machinery and equipment replaced today would require funds considerably in excess of original cost. Although the rise in machinery prices has not been quite so sharp as that for structures (as indicated by our construction cost index) one can be sure that it would require funds considerably in excess of original cost of any prior date to replace facilities, because practically all plant equipment costs are now at their all-time peak. Nevertheless, *Accounting Research Bulletin 43,* published by the American Institute of Accountants in 1953 (incorporating Bulletin 33 issued in 1947, dealing with the subject of depreciation and high costs and also quoting from a release by the American Institute in October 1948) reaffirms the opinion expressed earlier supporting cost-basis depreciation. However, six members of the Committee dissented.

Leaping Over the Arguments

Thus, there is an exciting scrimmage going on, which may be all to the good. My hope is that the problem will be solved before it is too late for management to preserve its capital.

Management is interested in a practical solution of the problem of providing adequate funds for replacements as needed. Some companies are required, due to advances in the art in their industry, to replace equipment

much more rapidly than others. Prudent management does not permit accounting theory to dominate its thinking. Whether the accountant objects to "writing them up and writing them down" or objects to setting up appraised values on the books or objects to appropriations from surplus in creating a replacement reserve, his opinions are merely expressions of how the matter would be treated on the books. Management must provide for adequate funds, available when the time arrives, to replace equipment at present price levels. Proper weight must be given to the cost of probable replacements, so that these additional charges can be included and properly distributed as part of burden costs and included in selling prices.

We have under way an investigation for one of our clients, including a study of replacement needs over the next ten years through consideration of the condition, obsolescence and remaining useful life of present facilities. Naturally, consideration is being given to current costs of replacement as a basis for creating necessary reserves, through appropriations from present surplus, and gradually adding to these reserves as a cushion against the financial strain which will come when the funds are needed.

It might be mentioned that this particular engagement came about as a result of the generally accepted but unjustified belief that depreciation on cost was adequately providing for replacements. All of a sudden it became clear that huge expenditures are going to be required for the replacement of power equipment. This served to dramatize the situation and management decided to set aside adequate reserves to take care of replacements at current price levels in the future, precluding the possibility of paying dividends out of capital. I think that this is a practical approach to the problem from the standpoint of management.

From my own point of view, replacement cost is present tense and original cost is past tense. Nevertheless, some accountants see "red" every time replacement cost or reproduction is mentioned. Therefore, I might suggest new terminology, such as value in use or current service value. This might remove a stigma that troubles the conscience of certain sincere accountants who, nevertheless, are diehards on this subject. Speaking from the standpoint of engineer and appraiser, I believe that management should take appropriate action promptly, in making provision for replacements at current price levels, as a means of preserving capital, and taking a realistic position in fixing selling prices. It is not radical—rather it is the conservative thing to do.